THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE BROADER VIEW.

THE address with which Mr. Duddell commenced his term of office as President of the Institution of Electrical Engineers last week was marked by two special features: the breadth of view with which he surveyed the field of electrical activity to the very horizon, even invading the borderland which lies between it and the domains of kindred sciences; and the spirit of suggestion which inspired his comments on the developments which we may hope to see realised sooner or later. In both respects the address resembled in the abstract that memorable one delivered by his predecessor, Dr. Ferranti, two years ago; but in the concrete form the two were very different, faithfully reflecting the influence of the training and pursuits of their respective authors.

Our German friends divide the electrical industry roughly into two great sections: the "Starkstromtechnik," or strong-current industry, and the "Schwachstromtechnik," or weak-current industry, and of these two arts the immediate past and present Presidents of the Institution respectively are most competent exponents—a fortunate circumstance, for thus the claims of both sections are ensured due recognition. It may be somewhat surprising to the younger members of the Institution, but it is nevertheless a fact, as was once once emphasised by the President, that the "weak-current" section, the department of telegraphs and telephones and the like, to which the Institution owes its origin, is still more important than the supply, traction or manufacturing branch of the electrical industry in this country, whether its claims be based upon the total capital invested or upon the number of persons who depend upon it for their livelihood. Probably in this respect this nation is unique, the bulk of the submarine telegraph work of the world having been carried out by British firms, and still remaining largely in British hands.

Before we consider the technical features of the address, we may direct attention to a remark in the first paragraph, to which perhaps too great significance ought not to be attached, but which, at any rate, serves to indicate the attitude of mind of the new President with regard to the great Institution of which he is the head. He says:—"The Institution is installed in its new home. It has revised its Articles of Association, and it is now prepared, having got these matters out of the way, *to undertake its proper functions with regard to the electrical industry.* There is a wide field of work to be undertaken, on the one hand, in encouraging the publication of scientific technical knowledge, and, on the other, in looking after the interests of the electrical industry." The words which we have italicised are both a confession and a pledge; a confession that hitherto the "proper functions" of the Institution have not been adequately fulfilled, and a pledge

that in the future that reproach shall no longer be justly levelled at it. We do not wish, as we have said, to overload this passing phrase, but the sentence which follows it, outlining the dual functions of the Institution, proves that it was not framed without deliberation. The President, in fact, as he states later in the Address, endorses the views of his predecessor, and we shall look forward to the accomplishment of solid progress in the direction of broadening the scope of the Institution's operations and extending the benefits of membership.

Referring to the very small number of papers dealing with telegraphy that had been read before the Institution—only 12 or 13 during the last 10 years, out of a total of 400—Mr. Duddell expressed some surprise at the disproportion; but when it is remembered that the three subjects of land telegraphy, submarine telegraphy and telephony have almost from the beginning been highly specialised and shut up in watertight compartments, it will be seen that the result can hardly be wondered at. Now that the telegraphs and telephones are wholly in the hands of the Post Office, the division will be even more complete. Moreover, that very active and thriving body, the Institution of Post Office Electrical Engineers, which meets at the Institution building, naturally asserts a prior claim on all papers dealing with these subjects.

Naturally, a considerable portion of the address was devoted to the subject of wireless telegraphy, and the President lucidly outlined the principal problems that are awaiting solution, passing over his own important contributions to the art with the barest mention; indeed, it was left for Sir John Gavey to point out that Mr. Duddell was the first to provide a means of measuring the infinitesimal currents received in the antenna, thus making a great stride towards placing wireless telegraphy on the firm footing of an exact science. Without measurement one works in the dark, and Mr. Duddell himself pointed out, in his reference to the science of sound, that the lack of means to measure the energy of sound waves was one of the causes of its backward condition. From the number of systems of producing radiant energy that are now in the field, and the activity with which research is being prosecuted in various directions, it is safe to predict that a few years will see vast changes brought about in the technics of wireless telegraphy.

An interesting comparison was that which the President instituted between the limits of perception respectively of light, sound and Hertzian waves. It appears that all three are approximately on a par in this respect, the radiation of 200 or 300 watts being in each case just perceptible at a distance of 100 miles. This is a very remarkable fact, though it may, perhaps, have no great significance, and at least it demonstrates the extraordinary sensibility of our senses—and our wireless receivers. The power expended is about equal to the maximum rate at which a man could work for a short period.

The President made a timely reference to the great and increasing importance of the allied subjects of electrochemistry and electrometallurgy, industries which as yet have received but little attention in this country, though they have attained to enormous dimensions abroad. We doubt whether it is fully realised that if a scheme were carried out on a sufficiently large scale, with complete utilisation of by-products, and suitable choice of processes to secure a load factor of 100 per cent., it would be possible to develop these industries in this country using coal as the source of energy, with commercially satisfactory results. Our lack of large water powers is not so great a handicap as superficial consideration would lead one to believe; hydraulic works are costly, and water powers are usually situated far from the raw material as well as from the consumer of the finished products.

Returning to this subject later in the address, Mr. Duddell drew attention to the importance of the nitrate industry in connection with agriculture; already over 100,000 KW. of plant is devoted to this industry in Norway alone, and this figure will be doubled at no distant date. Not only for the purposes of agriculture do we require nitrates, but also for the manufacture of explosives, for the essential constituent of which we are at present wholly dependent upon foreign sources.

In the concluding portion of the Address the President indulged in some interesting speculations regarding the possibilities of future progress in the production of radiation by electrical means. As in wireless telegraphy the problem is to produce long waves of radiant energy, so in illumination the production of excessively short waves, is required; at present the efficiency attained in the latter case is exceedingly low—not above 5 per cent. at best, and under 1 per cent. over the whole range from coal to light. Good work, he said, is being done in the borderland between electricity and radiation, which will bear fruit in the course of time. The converse problem was also interesting—the conversion of the sun's radiant energy into electrical energy. London receives 100,000 KW. per sq. kilometre in the daytime, and if only one-tenth of this could be made available. it would far exceed the present demand for electricity. But we are a long way indeed from achieving success in this direction, and as Mr. Duddell remarked, for the present it is better to develop the water power of Norway than to build radiation traps in the Sahara.

We are pleased to add, in conclusion, that, by a happy coincidence, the Royal Society has just conferred the Hughes Medal upon Mr. Duddell for his investigations into technical electricity.

Legalised Illegalities.

After the lapse of some five years, the full and deadly effect of the Trade Disputes Act has been made manifest by a decision of the House of Lords. Hitherto, many of us have been cherishing the belief that a Trade Union was only "above the law" in the sense that it could not be sued for any wrongful act done in the course or furtherance of a trade dispute. But this is a gross understatement. In future we shall exist—or try to exist—under a state of law which declares that no action founded upon any tortious act alleged to have been committed by or on behalf of a Trade Union shall be entertained by any Court. This state of things was revealed in a judgment of the Upper Chamber on November 18th.

The plaintiffs, who were printers, sued a Trade Union and two of its secretaries, claiming damages for libel and conspiracy. The alleged libel consisted mainly of the contents of a document entitled "The Compositors' Fair List and Guide to the London Printing Offices," sent by the defendants with covering letters to actual or possible customers of the plaintiffs. The plaintiffs, by their statement of claim, alleged that the purpose of the communication was to injure them by representing that they had been guilty of unfair dealing in their business, that they treated their employés harshly, and never employed Trade Union compositors, and that they were not, therefore, fit persons to be entrusted with the execution of orders for printing.

The Trade Union applied that its name be struck out of the writ of summons on the ground that the case as presented by the plaintiffs disclosed, by reason of Sec. 4, Sub.-sec. I, of the Trade Disputes Act, 1906, no reasonable cause of action against the Trade Union. The Court of Appeal held (Lord Justice Farwell dissenting) that the name of the Trade Union must be summarily struck out of the writ of summons, and the House of Lords has affirmed the decision.

It were idle, even if it were respectful, to criticise this decision of the Supreme Tribunal. Their Lordships have laid down the law; and that law can only be altered by Act of Parliament. We wonder whether the public will ever realise the position into which the country has been driven by the machination of those who promoted, and the folly of those who passed, the Trade Disputes Act, which is the *fons et origo* of this new and preposterous doctrine. We do not know anything of the merits of the case in question: the plaintiff, of course, apparently has his remedy against the secretaries. But the serious result is that a Union is under no liability, so far as its funds are concerned, for any tortious act. It can falsely imprison, libel, slander, maliciously prosecute, assault, or act negligently towards any subject of the King without his having any redress by action at law. And we are in the year of grace 1912!

THE COMMERCIAL DEVELOPMENT OF ELECTRICITY SUPPLY.

I.—Organisation.

At first sight it might be supposed that this subject had been worn somewhat threadbare. Many articles from able pens have appeared in the technical Press from time to time, but they have been more or less of a fragmentary nature, and have not dealt with the subject comprehensively.

It is undeniable that abnormal progress has been made generally within the last few years, but those who have been keenly watching the trend of events recently, cannot but admit that the many powerful forces which undoubtedly exist for the betterment of the industry have not been intelligently co-ordinated. It is now high time that the subject was tackled at the root. In some quarters much activity is employed unprofitably, in some a complacent attitude is adopted, while in others apathy is supreme. At the best, spasmodic local effort is the order of the day.

Among the contributory causes to this undesirable state of affairs, municipal control may be said to be the chief. In the introduction of party politics and self-glorification of individual members of the committees, the best interests of electricity undertakings are often entirely submerged, and the financial stability of the departments are undermined by prodigal contributions to the relief of local rates. On the other hand, the meagre capital available, and the frantic efforts to maintain dividends under any consideration, effectually preclude the possibility of independent effort on the part of the majority of companies.

On every side we are confronted with evidence of the disadvantages under which the industry is labouring owing to lack of effective co-operation. It may be pointed out in argument that the Electric Supply Publicity Committee was formed with the object of serving mutual interests, but although it has undeniably aroused some slight preliminary enthusiasm, it has accomplished little beyond the issue of a few circulars and booklets, and promises to settle down as a mutual admiration society.

All credit is due to those members of the executive whose services are given gratuitously to the cause, but, however well intentioned, their efforts are of the spare time variety and amateur in point of expert commercial requirements. That the support accorded to the Committee by the industry is not so cordial as may be desired, is probably due to the fact that the various authorities realise that the activities of the Committee are ineffective. The more influential undertakings have probably members of their own staffs better able to deal with their own particular requirements, and the smaller ones, especially if long distances from the metropolis, may not consider the benefits offered commensurate with the contribution solicited.

It may be safely assumed that the recent developments in the organisation of the gas industry have been seriously followed by all vitally interested in electricity supply. That the potentialities of the competition of electricity are keenly appreciated by gas manufacturers is evinced by the formation of the Commercial Gas Association. The deeply interesting proceedings of the Manchester Congress, one of the outstanding features of which was the masterly presidential address of Mr. Woodall, point unmistakeably to the determination of the industry to further the progress of gas by every possible means. The Association has received the whole-hearted support of gas supply authorities throughout the land, and also of the allied industries, and has engaged a permanent staff of officials specially qualified for the work of the Association, from whom a strenuous forward policy may confidently be expected in the near future. Backed by large financial resources, and under the guidance of an executive composed of the magnates of the gas world, the far-reaching propaganda outlined will tend to retard the tide of electrical prosperity unless immediate steps are taken to counteract it.

The urgency of the necessity for prompt action on the part of the electricity supply industry is most pronounced on account of the important and far-reaching improvements in the manufacture of apparatus, and the consequent extension of the use of current, for heating and cooking, as in this respect the supremacy of gas apparatus is now being seriously assailed. Half-measures will be unavailing, and an Association is needed which will command the confidence and support of all whose interests are allied. As a suggestion, such an association might be named the Electricity Supply Development Association, the executive of which might be comprised of influential members of the electricity supply industry, and possibly representatives of the Manufacturers' and Contractors' Associations. A general manager should control a permanent staff of subordinates, specially selected for the work of various departments.

An Association formed on these or similar lines could carefully foster and encourage the growth and welfare of the industry, and representations from it would be dignified and assured of respectful consideration. The principal sphere of activity would be in the preparation of suitable publicity literature and Press announcements, but among other important matters would be the organisation of exhibitions, the training and employment of canvassers, lecturers and demonstrators, compilation of statistics, and examining and reporting upon apparatus. The Association should thus be in a position to strike a blow quickly and decisively at any point where the interests of electricity supply were assailed, and might adopt a less appropriate motto than the old slogan, "All together, all the time, for everything electrical."

II.—The Commercial Engineer.

At the outset, let it be distinctly understood that this title does not refer to the individual engaged merely in canvassing, and without any special qualifications. There are a number of people at present doing very useful work in this direction, among whom are probably some engineers who, realising the importance of commercial experience, are adopting this opportunity of increasing their qualifications, which in order to meet the approaching demand must be very comprehensive.

In the early days of electricity supply the success of an undertaking was regarded as assured, solely by the engagement of highly trained engineers to run and maintain the generating station and mains network, but although these objects are meritorious and vitally necessary, beyond retaining the good opinion of existing consumers, they have no direct bearing on the acquisition of new business.

Owing to their different methods of operation, electric supply companies were, as a rule, better equipped in regard to commercial organisation than municipal undertakings, their secretarial and accountancy departments being essential to their existence, but even they have failed to move with the times by taking a comprehensive view of the necessity for special activity in development tactics.

In the case of municipal undertakings which are nominally controlled by a misfit imitation of a board of directors, namely, a committee of members of the community periodically elected for their political party faith, the question of administration has been neglected. Chief engineers who have been appointed on the strength of their abilities as engineers, and have gradually assumed the duties of general managers, cannot be expected, without careful consideration, to draw attention to their own lack of commercial experience, and they possibly view with some misgiving the introduction of a new factor in the problem, namely, the commercial engineer, the man who until quite recently was treated with supercilious toleration. In reality, however, they need suffer no more loss of prestige than the general practitioner, or even the expert in one department, who calls in the aid of a specialist to deal with a grave case in which he is insufficiently experienced.

To the credit of some chief engineers, it should be stated that they have courageously admitted their limitations, and have instituted a forward policy by recommending the appointment of commercial managers to organise business-getting departments, and develop the resources of their undertakings, but as a rule commercial methods are regarded by the technical staffs as derogatory. This is less to be expected as, owing to rapid improvements made in machinery by manufacturers, and simplification of systems, the operation of generating stations and mains networks is becoming more automatic, and a glance at the salaries offered in connection with vacant positions in these departments affords evidence that such services are not appreciating in value. The glamour of

officialdom may be responsible for the blinding of some of our embryo chief engineers to the fact that, as members of the staff of an electricity supply authority, they are actually engaged in trading, and that expert administration is as commercially necessary to their undertaking as to the establishments of the draper and grocer, to whom current is retailed.

It is a matter of some difficulty to obtain reliable statistics as to the true financial position of many undertakings. Except for one, or perhaps two, underpaid and overworked clerical hacks at the station, the staff for commercial routine is not provided. The keeping of stores accounts, and the allocation of costs, are generally muddled through in a very rough-and-ready fashion. The issue and collection of accounts for current are in most cases not under the control of the borough electrical engineer, but are dealt with at the municipal offices under various individual arrangements.

Thus equipped, the administrative bodies of most undertakings from the outset sat tight, and complacently awaited the promised flood of prosperity, but recently many have begun to realise with some uneasiness that the millennium is receding. Some have boldly ventured the opinion that the time has *now* arrived when a canvass of their territory is advisable, while others have adopted the expedient of employing meter fixers and arc lamp trimmers as canvassers in their spare time, and to assist in these activities half a hundred-weight or so of publicity literature has been purchased, the greater part of which accumulates a deposit of dust in a corner of the office owing to the lack of means to distribute it.

There are, of course, some outstanding examples of undertakings which are run on up-to-date and efficient lines, but it must be regretfully admitted that in a greater or less degree the foregoing indictment includes the majority of the supply authorities in this country. A thorough realisation of the parlous state of the industry must compel serious attention to the acute need for reform. Pedestals must be vacated, and the occupants be prepared to assist in the deliberations which must follow the breakdown of the obsolete methods hitherto employed. Curiously enough, invaluable assistance may be rendered by the man who may not possibly have received any training in central station or mains routine, although such experience forms a useful basis for many other essential qualifications. The commercial engineer is here referred to.

In most successful commercial enterprises engaged in the manufacture of a commodity, the immense value of the distributing organisation of factors, or selling agents, is fully taken advantage of. The manufacturer makes his arrangements with those he considers will dispose of his specialities to consumers to the greatest extent, and devotes his energies to the lowering of the costs of production, and maintaining adequate supplies to his distributors. The selling agents may, or may not, have spent some time in the manufacture of the commodity in question, but, what is to the point, they are in a better position than the manufacturer to dispose of it to the public. Thus there seems to be sound argument for treating the generation and sale of electricity on somewhat similar lines.

There are, no doubt, at the present time a number of commercial engineers (and it is to be sincerely hoped that their ranks will be greatly augmented) whose services could be advantageously employed to infuse new life into the industry as selling agents or business-getters, apart from the reorganisation of existing chaotic commercial conditions, and a consideration of desirable qualifications may be of advantage.

In this connection men of first-class education and address only can hope for success, and after a preliminary training in a central station, which, after all, is not of major importance, they should immediately endeavour to widen their scope by practical experience in many other branches.

A working knowledge of general engineering and drawing office practice is essential, and thorough experience in modern business methods, fluent and tactful correspondence, accountancy and finance are most valuable.

Contrary to general belief, complete knowledge of installation details is not acquired by central station and mains practice, and a few years spent with a good contractor will convince the unbeliever of the truth of this statement. The expert knowledge required to advise upon and fit up modern installations for lighting, heating, cooking and power is considerable, and the commercial engineer must be in a position to decide upon the most effective and economical manner in which these details are to be carried out. The construction and performance of all the latest apparatus must be thoroughly familiar to him, and also the latest applications of the principles of illumination.

The preparation of publicity literature and Press campaigns provide other outlets for his activities, and his judgment here must not be at fault. Electricity supply is in many respects seasonal, and his literary experience must be sound, even if suitably prepared matter and journalistic assistance are available. His discrimination in the value of advertisement will also be called upon.

In the supervision of the wily canvasser his knowledge of this work must be thorough, and here a few remarks may be appropriately made on behalf of that useful individual. The treatment meted out to him on many undertakings is not conducive to the best results. In numerous instances effrontery, and the ability to importune prospective consumers until applications are signed to obtain relief, are the main reasons for engaging the man in this capacity, and when his persuasive powers show signs of waning he is replaced by new blood. This procedure does not make the occupation in the least dignified, neither does it provide the necessary incentive to good work in the interests of the department, and with a better understanding of the broader policy, it is to be hoped that the status of the really efficient canvasser will be considerably raised. Properly organised and carried out canvassing is one of the most effective methods of increasing business, but emulation of the tactics of industrial insurance companies and flash jewellery merchants must be eliminated.

Wild and erratic statements with regard to the uses of gas which cannot be substantiated should be discouraged. Such methods are undignified, and not calculated to assist the cause of electricity. The comparative disadvantages of gas can be discussed in a sound businesslike manner which is worthy of the best traditions of the electricity industry, and at the same time will not give unwarranted offence to men of high commercial ability in the gas world, from whom we of the electricity supply industry have a lot to learn. The acquaintance of the commercial engineer with gas appliances should, therefore, be of more than the nodding variety.

Lest our paragon should appear incomplete, it may be added that tact and the ability to control a varied staff are essential to the success of his efforts.

A number of youths are being regularly turned out as switchboard attendants, or indifferent shift engineers, after serving a perfunctory term of pupilage in central stations, and those possessing the necessary abilities, initiative and capacity for hard work, might alternatively be utilised as raw material for ultimate commercial engineers. They would, at least, escape the monotony of central station routine, and the possibility of following what, owing to lack of scope, promises to become a variety of blind alley occupation.

(To be continued.)

FROGS' MUSCLES AS WIRELESS DETECTORS.

By DR. ALFRED GRADENWITZ.

Dr. Lefeuvre, professor at the Medical High School of Rennes, has devised the following arrangement for recording the contraction of a frog's muscle as produced by the passage of an electrical stimulus through a motive nerve.

The muscle M is solidly fixed in its upper part by means of a pair of tongs, as shown in fig. 1. The end of the sinew is connected by means of a wire to a light lever L pivoted round O. This lever is brought back to its initial position after the contraction is completed, by a weight suspended underneath, and the end of the lever which carries a fine point comes very close to a smoked cylinder performing a uniform rotation. At the very moment the muscle is excited by the intermediary of its nerve N, the contraction

curve, enlarged by the lever, is recorded faithfully on the smoked cylinder. While many cold-blooded animals can be used for this experiment, the muscles of frogs' legs are particularly well adapted for the purpose, on account of the regularity of their form, the long duration of their excitability and the special ease with which they can be separated from the body.

So far from severing the muscle completely from the body of the animal, it is, however, preferable to leave it in position, cutting the "Achilles" sinew at the junction, and fixing it to the wire connecting with the lever. In this case the central nervous system of the animal should first be

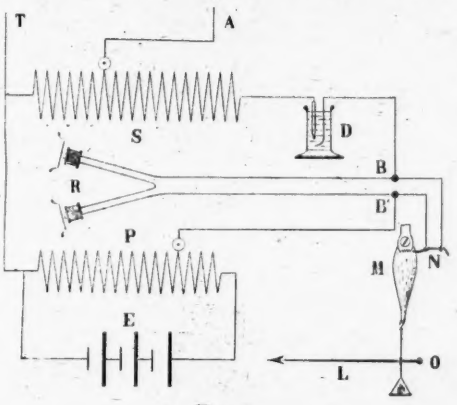

Fig. 1.

destroyed, lest the experiment be disturbed by motive reflexes. The sciatic nerve is further dissected over a short distance at the level of the thigh, and is lifted by means of the wire hooks which supply the electrical stimulus.

The neuro-muscular apparatus is so extremely sensitive to electric stimuli, that it can be used as a sensitive galvanoscope, allowing the very slightest electric variations or waves to be detected. In the arrangement above referred to it

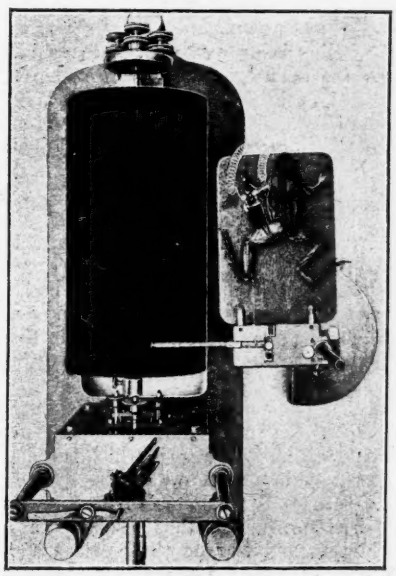

Fig. 2.

further affords the advantage of allowing its indications to be recorded. The following arrangement of connections is employed when using the apparatus for the receiving and recording of wireless signals.

As shown in the diagram above, fig. 1, E is a battery of three cells, P a potentiometer allowing the voltage in the receiving circuit to be controlled, S is a tuning coil to which the receiving antenna A is connected, D an electrolytic detector, and R two high-resistance telephone receivers connected up in series.

To the terminals B, B^1 of these telephones are connected in shunt two wires applying the electrical stimulus to the nerve N through the intermediary of small metal hooks. The excitation of the nerve is due to the self-induction currents produced in the coils of the telephones.

The tracings reproduced in fig. 3 were obtained at Rennes by means of the arrangement above described, and are records of the time signals given out daily from the radio-telegraphic station of the Eiffel Tower. The distance between Paris and Rennes is about 300 km. These signals comprise a preliminary signal calling the attention of the observer to a subsequent signal of very short duration, which marks standard time. The time signals are sent out from the clock of the Paris Observatory, which is fitted with a contact actuating the transmission station at the Eiffel Tower. They are sent every morning at 10.45, 10.47 and 10.49 respectively. The preliminary signals are different for each of these markings, and can be expressed in the Morse alphabet. The tracings allow the preliminary as well as the time signals to be distinctly recognised, and when using a very fine style and only slightly smoked paper, they are seen in their upper part to show very fine indentations, the number of which corresponds to the rate of vibration of the transmitting apparatus.

This method of recording time signals is of a remarkable accuracy. The time passing between the moment of excitation of a frog's muscle and the moment of its contraction is, in fact, extremely short. Moreover, this time—

Fig. 3.

the latent period of contraction, as it is called—is a well-known factor, in the present case about one-hundredth of a second, for which due allowance can be made. As regards the delay due to the time taken by the wave in traversing the distance between Paris and Rennes, this is absolutely negligible, the rate of transmission of Hertzian waves being practically the same as the velocity of light, viz., 300,000 km. per second.

While this arrangement is an interesting laboratory apparatus, it is not likely to become a device suited for practical purposes.

A London Exhibition of Mining Machinery.—The mining machinery exhibition to be held at the Royal Agricultural Hall, Islington, N., from May 29th to June 7th, 1913, is the fifth of the series organised by Messrs. Montgomery. We are informed that a strong association of manufacturers representing leading firms in the industry has been formed, and these exhibitions have now become quinquennial, so that after next year there will not be another exhibition until 1918. This arrangement both prevents a tax on the manufacturer through the multiplicity of exhibitions, and enables each to be thoroughly representative. Already three-fourths of the available space has been taken up, and a strong Consultative Committee has been formed to supervise demonstrations of life-saving, &c., apparatus and devices, to organise lectures on subjects of immediate importance to those engaged in mining operations, and to secure the attendance of British, Colonial and foreign representatives of mining institutes, &c. The Committee consists of Mr. W. E. Garforth, LL.D. (President of the Institution of Mining Engineers); Sir Ralph Ashton; Prof. J. S. Haldane, F.R.S.; Sir Henry Hall, I.S.O.; Sir Thomas H. Holland, K.C.I.E., F.R.S.; Mr. A. M. Lamb, M.Inst.M.E.; Mr. H. C. Peake, Past President, Inst.M.E.: and Mr. H. L. Sulman, Past President, I.M.M. Lectures have already been promised by Prof. Haldane, F.R.S., and other well-known authorities. The offices of the exhibition are at 43, Essex Street, London, W.C.

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THE ELECTRICAL EXHIBITS AT THE OLYMPIA MOTOR-CAR EXHIBITION.

By CHAS. J. WEBB, A.I.A.E.

While it has unfortunately to be admitted that in this country at least the onward march of the petrol car would seem to have pushed the electromobile almost completely out of the field—there was not a single electrical motor vehicle on view—the annual Automobile Exhibition held at Olympia, W., last week, under the auspices of the Society of Motor Manufacturers and Traders, afforded striking evidence of the immense business in electrical specialities that the development of the automobile movement has created. A walk round the accessory exhibits in the galleries showed that at practically every other stand some product of electrical works was displayed. The ignition of the explosive charge in the combustion chambers of petrol engines is now almost exclusively effected by means of high-tension magnetos, of which there is a considerable number of makes on the market. By far the most popular is the Bosch, but others appealing for public favour are the Eisemann, Simms, Nilmelior, C.A.V., Ruthardt, Unterberg & Helme (U.H.), Thomson-Bennett & Oleo, all of which contain many points of interest.

It is not only in magnetos, however, that a very large trade is being done; it is the same with sparking-plugs and other ignition accessories, electric lamps, electric horns, &c. The exhibitors in these sections were so numerous and the variety of their productions so large that a mere list of them would more than fill the space available.

The most striking feature of the Exhibition, and the one which calls for principal attention on our part, is the rapid development that has taken place as regards the adoption of electricity as the medium for lighting the lamps in and about motor-cars. Except on small-powered cars the oil lamp has for some years been practically out of the question, and for a time acetylene (itself indirectly an electrical product) held the field. During the past two years or so, however, marked progress has been made in adapting the dynamo to produce a constant current, notwithstanding the varying speed of the petrol motor which drives it, with the result that, where the question of expense is not a serious factor, electricity is rapidly pushing out acetylene, leaving the latter to supply the lighting on the less costly cars. Not only has the new departure been the means of spurring on dynamo designers, but it has brought a revival of business to accumulator makers. With the advent of the magneto as the medium of ignition, the latter experienced a considerable falling off in demand for the 4-volt accumulators which formerly supplied the current for ignition; now, with the adoption of electric lighting, they are enjoying a renewed demand for their productions, for practically all the dynamo lighting sets include a battery of accumulators in the outfit. Among the firms who showed accumulators for this purpose, in addition to the concerns exhibiting complete lighting sets, were Messrs. Van Raden & Co., Ltd., the Klaxon Co., Ltd. (Edison battery), and Messrs. Leo Ripault & Co.

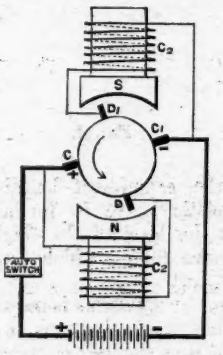
Another new departure which shows signs of considerable development is that of electrical devices for starting the petrol engine of the car from the driver's seat and so obviating the turning of the usual starting handle, examples of these being seen in the White & Crossley cars, the latter being equipped with the Scott-Crossley system, illustrated and described in the last issue of the Electrical Review. Another system in use on the Lanchester cars provides for the starting of the engine and for the lighting—through a battery—of the different lamps, while a third arrangement is that employed on the Cadillac cars, in which one electrical machine provides not only for starting the engine and lighting the lamps, but also furnishes the necessary spark for the ignition.

Appended are a few particulars of the more important exhibits.

Messrs. C. A. Vandervell & Co. are certainly to be classed as among the pioneers in adapting electric lighting to motor-vehicles, and the fact that there are now over 10,000 of the C.A.V. sets in use speaks volumes for the efficiency and practicability of the system.

It may be briefly mentioned that the dynamo is provided with four poles, two of which are unwound and two wound in the usual way. A special arrangement is made in the commutator whereby certain coils of the armature are continually short-circuited, the effect being that the magnetic flux is so distorted that the unwound poles become magnetised, and the current is produced in the usual way, and drawn off to the battery. As soon as the E.M.F. reaches a certain value, the subsidiary coils begin to act in opposition to the main ones, and as this antagonistic action is increased in exactly the same proportion as the strength of the main fields is increased, a perfect balance is obtained between the two, thus preventing the output exceeding a certain limit. Instead of a minimum-speed electric cut-out to prevent the battery from driving the dynamo as a motor, a free-wheel is arranged on the armature shaft.

One of the best-known dynamos for car lighting purposes is the Leitner, which was exhibited by the Rotax Motor Accessories Co. The feature of this machine lies in the fact that it is self-regulating, no mechanical or electro-mechanical devices being employed. The field magnets are shunt wound,



C C', Main brushes; D D', Subsidiary brushes.

Fig. 1.—Diagram Illustrating Action of Leitner Variable Speed Dynamo.

the shunt winding being connected up to a subsidiary brush working on the same commutator as the main brushes, but arranged at right angles thereto (fig. 1). When the speed of revolution is low this brush collects current and increases the excitation of the fields, but as the speed of the armature increases, the magnetic field flux is distorted in the direction of rotation, the consequence being that the voltage of the subsidiary brush is first reduced to zero, and then actually becomes reversed in sign, this negative current weakening the magnetic field to a greater and greater extent according as the tendency for the output to rise becomes greater. The generator is therefore automatic in action at all speeds. A minimum cut-out is provided in the form of a solenoid switch, contained in a separate casing from the switchboard.

The P. & R. dynamo, as its name suggests, is made by Messrs. Peto & Radford, Ltd.; it comprises a number of interesting details, notable among which is the provision of a dog-clutch, by means of which the dynamo when not required to charge the battery can be thrown out of gear with its driving medium, thus enabling a considerable economy in wear and tear on the bearings and brushgear. The dynamo, which has a capacity of 120 watts at 15 volts, is of the totally-enclosed shunt-wound type, and is fitted with an electrical minimum-speed cut-out and a mechanical voltage regulator. The latter is extremely ingenious, and comprises a double slipping clutch combined with the driving pulley; a governor ball combined with a double-ended toggle lever, according to the varying speed, releases or engages the clutches, thereby controlling the armature speed.

The governor pulley is entirely enclosed, and runs in oil; it is controlled by one strong compression spring. The gripping surfaces are composed of a material which wears almost indefinitely, and these being opposed to each other, and their surfaces being of the same area, end thrust is equal, and therefore practically eliminated. Messrs. Peto and

Radford also exhibited the "Diva" electric head lamp, in which, by an ingenious arrangement of mirrors, five distinct rays of light are obtained from one lamp.

The dynamo lighting system made by Messrs. Joseph Lucas, Ltd., has been on the market for the past few years, during which period, however, it has undergone various improvements. The machine is of the enclosed shunt-wound type; a mechanical device consisting of a slipping clutch is

Fig. 2.—The Lucas Dynamo, End Cover Removed, Showing Commutator and Brush Gear.

provided to ensure a constant output, notwithstanding the varying speed of the petrol-motor, by which it is actuated. The belt pulley through which the armature is driven, is furnished with a small friction clutch in which the frictional surfaces are engaged and disengaged by an automatic centrifugal governor, the whole being self-contained in a dust and oil-proof casing. The result is that, however fast the pulley be revolving, the armature shaft to which it is indirectly coupled cannot exceed a certain predetermined speed. When the armature attains its maximum speed, the friction clutch is automatically disengaged by the governor, and the driving effort momentarily ceases. Directly, however, the speed drops, the clutch again takes up the drive. A minimum speed cut-out is provided on the switchboard, the shunt winding being also broken when the accumulators are not being charged, so that the armature then runs quite free. Two sizes of the machine are made, 100 and 200 watts capacity respectively.

Messrs. Brown Bros., Ltd., exhibited the Brolt dynamo, the feature of which is the addition to the two main poles which are excited by a shunt-wound winding connected to the brushes of two auxiliary poles at right angles thereto (fig. 3); the latter are unwound but are

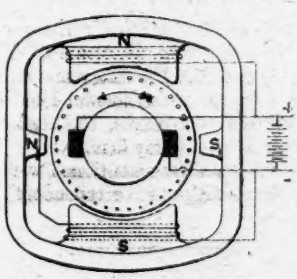


Fig. 3.—Diagrammatic Section of Brolt Dynamo.

excited by the cross-magnetisation caused by the working current in the armature. Two brushes are placed in the neutral position relative to the main poles, they being made wide enough to short-circuit several armature coils during the period of commutation. The action of the machine is as follows:—

When the armature is revolved a voltage is induced between the brushes exactly as in any ordinary dynamo, and the machine commences to charge the battery as soon as the necessary speed is reached. The load current in the armature exercises a cross-magnetising tendency which creates a magnetic flux in the auxiliary unwound poles provided to receive it. The armature coils short-circuited by the brushes cut this cross flux, and in consequence have a short-circuit current induced in them which is proportionate to the cross flux and to the speed of rotation. Any increase of speed is immediately accompanied by a proportionate increase in the short-circuit current, which demagnetises the main field, and keeps the output constant. Again, if the output current should tend to increase, an increased cross-magnetisation results, which, in turn, increases the short-circuit current, therefore preventing any increase in voltage. The automatic regulation of output is therefore obtained by purely electrical means, there being no moving parts whatever except the armature.

A minimum cut-out switch working on the solenoid principle is mounted on the switchboard to prevent the battery discharging through the dynamo when the latter is running at a low speed. A feature of the Brolt dynamo, which is made in three sizes—6 amperes at 6 volts, 6 amperes at 12 volts, and 12 amperes at 12 volts—is the rapid rise of the output curve, the maximum current being reached at twice the cutting-in speed.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The I.E.E. Examinations.

With reference to your remarks in the current issue referring to the examination for admission to the Institution of Electrical Engineers:—

I do not know who has been selected to settle this very important question, but as it is the most important of all the alterations, and on its satisfactory settlement the future welfare of the Institution largely depends, perhaps some outside expression of opinion may not be out of place.

As the graduate class is recruited largely from men actually engaged in studying to enter our industry, it seems quite unnecessary to impose any examination on this class. In any event, there should not be any examination for students who have already been articled to an engineering works or an engineer, or who have entered for a regular course of training at one of the recognised training institutions. This exemption might even be extended to anyone engaged in an electrical business during the day and attending any regular night classes.

Most of these classes have entrance examinations, and it will be a great pity if the Institution decides to hold such an examination itself. Omitting this first examination has one very important advantage—that the examination for the Associate Member class could then include a sufficient range of subjects to show that the applicant had a thoroughly good all-round general knowledge. The questions on these general subjects could be set on a very different level to that of a student's examination, and would be a considerable factor in raising the status of the members of the whole industry. The examinations on electrical subjects should be set to show that in this branch of physics and engineering the applicant was worth his London University degree.

Your suggestion for a *viva voce* examination would be excellent if it could be arranged without undue hardships on distant applicants, and if the right men to examine could be found at the various centres.

Percy Good.

London, S.E., *November 15th*, 1912.

The Institution of Electrical Engineers.

With reference to the letters in recent issues of the Review on the subject of the I.E.E. and "the 17s. a week man," it is certainly time some decided action was taken by those members of the profession for whom the I.E.E. has done, and is doing, nothing to improve their position, either financially or otherwise. While I do not for a moment

wish to decry the good work it has done in the past in furthering the interests of the industry, it must be admitted that to the class of whom your correspondents speak, the Institution, as a body, has been of little or no use. What is the reason for this? A number of reasons might be suggested, but the principal reason is the fact that the Institution contains too many members of the type of which "Subman" speaks, those to whom the financial advancement of the rank and file is undesirable for various reasons. Another cause is the presence of men in the Institution who are not, and have never been, connected with public supply work. Of course there are other causes, but to put the matter in a nutshell, the Institution by reason of its constitution, administration, and regulations, is of no use to the rising or younger members of the profession. As "Subman" states, one has only to glance over the advertisement columns of any of the technical journals to see the appalling condition of things, shift engineers, mains assistants, sub-station attendants and such, of whom the highest qualifications are asked, are offered the princely salary of £1 or 30s. per week, generally a seven-day week, and if one of these unfortunates has the impertinence to ask any more, he is promptly informed that his place could be filled immediately by a cheaper man. So much for the position of matters at present; now for the cause and remedy. Regarding the cause, several could be put forward, but I think there are two evils which are largely responsible. First, the premium pupil evil; and, secondly, the improver evil. As long as those responsible for running public supply concerns can obtain intelligent, well-educated youths (some of them University trained), anxious to get into the supply end of the business for a few shillings a week, and so long as this is permissible, so long will matters go on as they are. The question arises, how can this be prevented? I would suggest as follows:—First, by the establishment of a system of examination and registration by the Board of Trade, the same as in the case of marine engineers; this would effectively deal with the case of improvers, and such doing shift engineer's duties for a paltry remuneration, as it would be illegal for anyone who had not a certificate to be in charge of plant which was generating public supply, and, of course, the certificates would only be granted to fully qualified men. For sub-station men a similar scheme of registration and licensing could be arranged. This would be the legal part of the reform, now for the employés' part. The first thing to be done is the formation of a business-like organisation with a decided policy as suggested by "Subman." Some years ago we heard a lot about a proposed "assistant engineers' association," but apparently the idea fell through; but the time has now arrived for definite and decided action, and as one who has been connected with the supply section of the profession for some years, and has seen the condition of matters at their worst, I would venture to suggest the following:—That an association be formed to be known as "the International Electrical Association," membership to consist of shiftmen, junior assistants, and those younger members of the profession who are outside the ranks of the I.E.E. The objects of this organisation would be:—(1) The collection and publication of information regarding situations; (2) the formation of a standard wage scale, and the necessary steps for securing the same; (3) to seek for the Parliamentary regulation of supply staffs as regards the granting of licences and certificates; these would be the three principal objects. No doubt many readers will remark, "a tall order"; but as Mr. Abraham stated in his letter, what the British Medical Association and the Incorporated Law Society have done for the medical and legal professions, a properly-organised and enthusiastic Association can do for the electrical profession. Rome was not built in a day, but by steady, determined effort the rank and file can change for good the present state of affairs. Of course, the Association would not seek to act in an antagonistic or hindering manner towards any of the Institutes, and, as the suggested title implies, membership would be open to engineers in any part of the world. I must apologise for encroaching so far on your valuable space, but the best of the technical journals, the Review included, have supported us in the past, and it is to them we now look for further support and guidance. I leave it to an abler pen than mine to elaborate other details, but will conclude by saying that I shall be pleased to assist in any possible way, and hope that these remarks may stir up others to take decided action.

Zantha.

Contracts in India.

In your issue of October 11th, page 566, Vol. LXXI, No. 1,820, I have read with amusement a letter signed by Mr. J. Elliott, of Messrs. Greaves, Cotton & Co., of Bombay. I do not think there is much to be gained by my discussing closely the various statements made by this gentleman, but in order that you may see the position for yourself, I send you the original order for the illumination of Bombay, received by me from the electrical engineer to the Government, which you will see is dated May 16th, 1911, while Mr. Elliott, by his own statements, shows that he only submitted a tender on June 1st.

As the order had already been given to me in the middle of May, and it had been arranged with the electrical engineer that I should sail to London on June 3rd, in order to inspect the illumination work done there during the Coronation, and to purchase supplies for similar work to be carried out here during the Royal visit to Bombay, I have no hesitation in saying that the request that Messrs. Greaves, Cotton & Co. should submit a tender was only made to safeguard the electrical engineer to the Government of Bombay, and as unpleasant questions might have been asked by other firms as to why he placed the order with me without tenders being invited. I may also add that tenders were invited on June 1st with my knowledge and acquiescence.

To support what I have already stated about the Electrical Department, P.W.D., Bombay, I send you herewith a cutting from the October issue of *Indian Industries and Power*.

I quite understand Mr. Elliott's action, as his firm receive a great deal of work from Government without tenders being invited, and great dissatisfaction at present prevails owing to the electrical engineer placing most of his contracts with this firm. You can now see the reason why Mr. Elliott holds a brief for the electrical engineer.

I would ask you to be good enough to return the original order which I now send you, under registered cover, and if you wish any further details I shall be glad to place all my papers at your disposal, showing how I obtained the Government contract before tenders were invited from others.

I do not think that such a state of affairs would be tolerated for one moment in England, and it certainly cannot last much longer here; unless the Government remodel their electrical department there is sure to be a great scandal.

N. M. Marshall.

Bombay, *November 1st*, 1912.

P.S.—I have never traded under the name of N. M. Marshall, but always under the name of Marshall & Co., and perhaps in view of Mr. Elliott's remarks, it may interest you to receive a copy of a testimonial I have received from the Hon. Mr. Herbert G. Greaves, the head of his firm, and a list of work carried out by my firm.

[All the documents above-mentioned were duly received, and are in accordance with our correspondent's statements.—Eds. E.R.]

Fuse Formulæ.

Referring to my previous letters on this matter, I wish to point out that in the case of short circuits the interior of the fuse wire is undoubtedly at a much higher temperature than the exterior, and consequently the bursting effect frequently noticed is easily accounted for.

I do not see how a theory which puts the resistance per unit length equal to $\rho_0/\pi a^2$ (it really does not matter whether it is ρ_0 or ρ_θ) can possibly represent the facts. As is well known, fuses behave more like unstable liquid jets, in some cases forming larger and larger globules of molten metal till disruption occurs. In other cases there is the temperature gradient, which is great.

I do not see why Mr. Chapman should refer to my suggestion as "wild assertion." My views are backed up not only by my own experiments, but also by those of other people.

For instance, Preece found that for certain wires $C \propto d$, and for others $C \propto d^{3/2}$. Again, Ayrton and Kilgour "observed experimentally" that the current varied as the three-halves power for thick, and the first power of diameter for thin wires. Both these sets of experiments refer to raising a wire, or to be more accurate, the surface of a wire, to a definite temperature. I have already referred to some results by other experimenters.

Mr. Chapman refers to the high-thermal conductivity of copper, although I am not aware of any results for that substance at a temperature above melting point. He wishes me to believe that the interior of a fusing wire is at the same temperature as its exterior, and I cannot, since it is contrary to all experience.

I do not feel called upon to accept a theory as true which is demonstrably false, even though it be backed up by experiments correct to six significant figures (which it is not).

I referred in my first letter to certain formulæ in order to show that convection of heat, or conduction of heat, will not explain the difference alone, and suggest alteration of the path of the current.

In hydromechanics, as is well known, certain laws break down when the velocity of flow reaches a certain critical value for, say, water in pipes.

Regarding specific resistance (I prefer the old name) in text-books, we are informed that as the temperature rises we find that $\rho_\theta = \rho_0 (1 + a\theta + \beta\theta^2)$. Consequently, to obtain the resistance of a wire at any temperature, all we have to do is to insert the value for that temperature, and go merrily ahead. This may satisfy some people, and, I suppose, even degrees are granted to painstaking individuals who spend much time in accurately determining these constants, and reading papers on them. Yet such procedure, I humbly submit, is only a bungling process at the best, and I doubt whether the ingenious people who perpetrated the original monstrosity of calculating resistance in this way, ever intended it to be applied to molten fuse wires.

Regarding temperature gradients, anyone who has experimented with fuses will have noticed on many occasions that even when the current is slowly increased, molten globules are often shot out of the wire on fusing, and do not solidify for a considerable time; therefore, I am forced to conclude, both by experiment and by mathematical investigation, that the interior is much hotter than the exterior of a wire in that condition.

The theory put forward by Dr. Russell seems to be utterly impossible for many reasons other than those dealt with in my letters, although exceedingly interesting to me.

Meanwhile, all I wish to point out is that all the so-called theories of fuses are in a bad way, and are useless, and there is no numerical index covering all cases for wires, and that commonsense explains much.

Neither do I write this to influence people to throw their wooden gods overboard if they derive any satisfaction from keeping them; nor do I address those people (some of whom I have encountered) whose aperture for the admission of new ideas is boarded up and "No admission" written large on it.

I hope Mr. Chapman will not take this as referring to him in any way; I may say I have read his letters with much pleasure, and we seem only to differ in degree.

W. H. F. Murdoch.

Mill Hill, *November 16th*, 1912.

Electrical Sweating.

I notice in your last issue an advertisement by a London municipal authority, offering the stupendous salary of £65 per annum for the services of an assistant charge engineer.

The gentleman appointed must have had a good mechanical and electrical training, also experience! (save the mark) of a modern A.C. station. I note the authority in question are too ashamed to disclose their identity, unless, perhaps, they are afraid they will be inundated with prospective candidates.

I wonder how the chief engineer to this "authority" expects the fortunate (?) candidate to live, and uphold *his* authority, when most probably the labourers under him are in receipt of more remuneration than himself. It would be interesting to know the salaries of the rest of the unfortunate staff, and whether this system of sweating is carried throughout the department.

Most engineers with the training desired above, have had to serve several years' apprenticeship, and to pay large fees for their training, with the ultimate outlook as black as depicted in this scandalous advertisement. If this sort of thing is allowed to continue, what will the electrical profession degenerate into? One can only marvel that the advertisers did not add, "Gentlemen with private income preferred."

The unfortunate charge engineers at this station have my entire sympathy, as theirs must indeed be a dog's life under such disgraceful conditions. It is now quite time the suggested "Electrical Charge Engineers' Association" came into existence, and I should be one of the foremost applicants for membership.

Disgusted.

Speed of Signalling through Submarine Cables.

The remarks of Prof. C. L. T. Griffith, in your issue of November 15th, in regard to calculations relating to the constants of submarine cables, will be endorsed by all who have experienced the advantages possessed by a slide rule for this class of work. Several years ago the merits of the straight form of slide rule—which gives all values of pairs of D and d simultaneously, for a single setting on the logarithmic scale, in the manner now described by Mr. Griffith—appealed to me as being an excellent basis for a direct-reading instrument for cable calculations. There were practical difficulties, however, and I ultimately decided in favour of the equi-angular logarithmic spiral, as applied in acoustics. (See Donkin's "Acoustics." Second Edition, pages 26-27.) A few remarks concerning the reasons for this selection may be helpful to those who may desire to design such instruments.

It should be premised that the object is to design a *direct-reading* instrument to indicate log D/d, capacity, dielectric resistance, and, if possible, the weights of conductor and dielectric respectively, as well as the conductor resistance, and in special cases, perhaps, the inductance, per unit length. If only log D/d were required, the straight slide rule would be admirable for the purpose. Unfortunately, the range of cable calculations is represented by only about one-fifth of the length of the rule, and the space available for extra figures to denote capacity and dielectric resistance is thus forbiddingly small. It is still more difficult to find space upon such a rule for weights and other details. Similarly, if only log D/d is required, or if all the pairs of values of D and d corresponding to a given value of log D/d are to be determined, the Fuller cylindrical slide rule leaves nothing to be desired. The pointers can be set to fixed positions, corresponding to a given pair of values of D and d, the cylinder can then be moved so as to indicate all other pairs representing that ratio of diameters, and log D/d can be read off easily to four figures. This, however, is only one step towards making a direct-reading instrument for cable calculations, and again the difficulty is to find space for the figures required to denote the weights and electrical values.

The advantage of the equi-angular logarithmic spiral is that it can be drawn or engraved upon a plane card, with plenty of room for the figures necessary to make the instrument direct-reading. Its basis is a circle divided equally into 360°; and the additional scales needed to indicate capacity, dielectric resistance, and log D/d, are concentric circles similarly divided, which can easily be increased in number. Moreover, the radial scales are divided into equal parts, and they may conveniently carry the figures indicating weights or conductor resistances. It avoids, in fact, the difficulty of the division of scales into logarithmic parts, by transferring the logarithmic operations to the spiral. The defect of it is, or was, that the D and d readings on the radial scales near the pole of the spiral are rendered inaccurate by the rapid change of curvature approaching that point. This

defect is completely overcome by drawing a second spiral exactly like the first, but moved further round the circle in the manner described in the paper to which Mr. Griffith refers, and in the *Proceedings* of the Physical Society, Vol. XXIV, Part II, 1912.

The conclusion seems to be that either the straight, cylindrical, or equi-angular logarithmic spiral form is available for cable calculations. Preference is to be given to the straight form when all the pairs of D and *d* are to be selected for a given value of log D/*d*, without reference to electrical values. The Fuller slide-rule is to be recommended for working out particular cases, and for extending the calculations. For a direct-reading instrument, the equi-angular logarithmic spiral, provided with a secondary spiral, is probably the best. This equi-angular logarithmic spiral must not be confused with the ordinary spiral "slide-rule." It must necessarily be a specialised instrument, marked to suit the particular materials or problems with which an individual user may happen to be concerned. The primary and secondary spirals, of which the co-ordinates are given in my paper (*l.c.*), however, will be found to apply to all cases, and in general only the figures on the circular and radial scales will require alteration with change of conditions. Will you allow me to add that the instrument is not patented, and that I have no financial interest in it or in any form of slide-rule?

Rollo Appleyard.

November 15th, 1912.

Patents and Inventions.

I have read with interest your report of the address of the Chairman of the Birmingham Section of the Institution of Electrical Engineers.

Mr. A. M. Taylor makes the rather startling proposal that it should be absolutely illegal for an employer to compel an "employé to hand over to him his invention." Surely so far-reaching a suggestion should hardly have been advanced by an ex-officio member of the Council of the Institution without some limitation.

If the author of the address will kindly define his terms "employé" and "invention," I will, with your permission, endeavour to point out the objections of one employer, at least, to such legislation.

Something Wrong.

Generating Plant for Village Lighting.

I have read with interest the letters in your "Correspondence" columns respecting the electric lighting of small towns, say, of 6,000 to 10,000 inhabitants. I should be pleased to hear if a scheme, as follows, has been tried.

The difficulty appears to be to get a steady load over the biggest part of the day to keep the engines and staff profitably employed. Why not, in the case of a lighting company, take up a side line requiring power and work it themselves? Say a brickyard or corn mill. It should not be difficult, by advertising or otherwise, to build up a profitable business on these lines, which would do a lot towards paying a dividend.

M. A. P.

Stands for Cooking on Inverted Electric Irons.—The Marion Light and Heating Co., Marion, Ind., recently distributed among its customers who have electric irons little stands for holding the irons in an inverted position for cooking, heating water, &c. The holders were simply and substantially constructed of ⅜-in. by $\frac{1}{16}$-in. iron, securely riveted and painted with aluminium bronze. In lots of 100 they cost 15 cents each, but they were given away by the central station to any customer owning an iron who called and asked for a holder. The holders fit any kind of electric iron and adapt the upturned heating surface for warming water, cooking eggs, boiling coffee, warming baby's milk, &c. With no other device than the electric iron in the house, a fair breakfast can be prepared in a few minutes. The holder is also useful for other household operations, such as steaming velvet, &c. Mr. S. H. Smith, local manager, checked the consumptions of several customers who employed these holders to amplify the uses of their electric irons, and found that those compared had each increased consumption by about 15 cents' worth, so that the little stands paid for themselves the first month.—*Electrical World.*

THE OFFICIAL BALANCE A TALE OF A TEST.

By A.M.I.E.E.

"The official balancing of the electrical circuits on H.M. Ship —— will commence on the —th inst. Please attend."

So runs the usual notice received by contractors for electrical machinery and apparatus to H.M. Navy.

The operation with the above high-sounding title is merely the testing, for continuity, conductivity, and insulation resistance, of everything electrical on board the ship, and is so named from the use which is made of the "bridge" method for conductivity tests; hence the term "balancing the bridge" has given the test the name of "The Official Balance." As this test is most dreaded by all taking part in it, the following account of an insulation test, which, for sheer strenuousness, eclipsed anything in the writer's experience, may be of interest to readers.

The bare recital of the fact that after being fitted and tried on board, and before final acceptance by the authorities, all electrical apparatus must pass a certain test to prove the quality and condition of the insulation, conveys very little to electrical men who have not had the actual experience. For instance, a motor left standing for a week on the open deck in the rain, or in a compartment awash with water for eight months, or to have a motor used as a platform by a driller, who manages by some feat of juggling known only to his species to mess up the interior with soap suds, or to have the compartment in which a motor is fitted entirely filled with water in order to test watertight doors, are all mere incidents exciting no comment, being just part of the game.

On receipt of the customary notice the writer repaired to the Royal Dockyard at ————, arriving on a Monday. Amongst other things the writer was responsible for two motors of 140 and 30 H.P. respectively, and the first deadlock occurred right away. The orders were that all drying-out and testing was to be completed within the week, as the ship was going to sea on the following Monday; while from another department came a special order to the writer that nothing must be taken apart, as the motors were required for use on the Thursday. The second order thus rendered the fulfilment of the first quite out of the question. The motors, while quite workable, were in a very damp condition owing to the compartment in which they were fitted having been awash with water for six or eight months. However, something had to be done, so we commenced on the large motor with the usual recognised methods of drying a motor without dismantling it.

The writer's staff consisted of a chargeman erector, two erectors and a labourer—all non-electric men. The first thing was to get a squad of labourers to clear out the water, no easy task, and dockyard "maties" are not given to hustling.

For the remainder of that week every effort was made to heat up the motor. We ran it, "stalling" it at intervals with the brake in order to get a good volume of current through it. We packed 50-C.P. lamps inside the motor and controller, and left the shunt circuit "on" at nights. On Thursday we had a full-load run for a few hours, but all to no purpose; that motor absolutely refused to warm up. We continued the treatment until Saturday, and we were then informed that Monday's trip was postponed until later in the week, so we immediately commenced with stronger measures.

A quantity of prepared charcoal, guaranteed free from fumes, and several perforated metal bowls were procured. We then opened out the machine, which had a diagonally split hinged frame, and lifted out the armature—an operation easily accomplished in the shops, with cranes, &c., in about 30 minutes, but which took exactly 15 hours between decks on board ship. Only those who have had similar experience can understand. The armature weighed over a ton, and was bulky in proportion. There was barely room, between the highest point of the motor frame when open, and the beams overhead, for the armature and chain blocks. The motor lay with the spindle fore and aft of the ship, and the

only available deck space on which to land the armature was on the starboard side of the motor; but this space was taken up by the top half of the now open motor frame, the hinge being at the lower end of the diagonal joint. On the port side of the motor a vertical shaft blocked the way, so we planned to lift the armature clear of the frame, block it up with timber, move the chain blocks to port, take a fresh lift and swing the armature as far to port as the vertical shaft would allow, close the motor, block up the armature again, move the chain blocks to starboard, lift the armature again and swing it over the top of the motor and land it on the deck. All this was accomplished, after indescribable trouble, up to the point of trying to get the armature back over the top of the motor. This we found to be impossible. The highest part of the frame when closed was just a trifle higher than the highest point when open, and this trifle made all the difference; we could not get another quarter inch of lift, so there the armature had to remain. We blocked the armature up with timber, allowing it to rest upon its spindle, but allowing the slings to remain for safety. We then started the charcoal fires; two of these were put under the armature, one upon an iron plate, which was placed upon the bottom pole-piece inside the motor, and two under the main controller. The motor, armature and controller were then covered over with pieces of sail cloth, sacking, or anything procurable, to keep in the heat, and one of our number remaining to watch, we left the ship about 4 a.m. on Sunday.

The charcoal fire treatment was continued on Monday with good results, all the parts warming up nicely, but a new difficulty presented itself. The fumes off the charcoal were so deadly that to remain in the compartment for long was impossible, and yet the fires could not be left, as varnish might run and drop into the fire causing a flare up at any moment. We therefore started the ventilating fan, but the weather being wet at the time this resulted in damp air being pumped into the compartment, undoing all the good the charcoal fires had done—the insulation resistance appreciably dropping in a very short time—so we had to stop the fan and put up with the deadly fumes. The effect of charcoal fumes is curious, causing frightful pains in the head, and when human endurance can stand no more, and the sufferer climbs out into the fresh air, he loses all power in his limbs, sometimes collapsing upon the deck; the fresh air having that effect. All suffered terribly, two of our number being laid off, but as the treatment was having the desired effect, and either coal or coke fires were quite out of the question, we persevered in spite of all drawbacks.

Towards the end of the week all the parts of the motor seemed perfectly dry, testing out well and quite up to standard. The main controller was not so good, but we decided that we could continue the treatment upon this while putting the motor together for the official test, which we now proceeded to do, as official tests are only made upon complete machines, not upon disconnected parts.

When we got the motor together again, we found, to our unspeakable disgust, that everything was as damp as when we commenced, so that any official test was out of the question. This was a facer. We found that the apparent dryness had been surface dryness only; the moisture in the armature core and F.M. coils still remained, the heat having dried the outer tape, &c., only, and the damp sweated out again in a few hours' time. This brought us back to the starting point again, so, in desperation, we tried all we knew to heat up the machine. The brushes were "shorted," and double full-load current passed through the series coils, this being varied by "shorting" the series, disconnecting the shunt and passing double current through the armature. This was kept up until the heat from the resistance grids blistered the paint off the controller case, but with little effect upon the motor. At this juncture we had a complaint from the "juice" department that we were appropriating the entire output of one generator, at the same time notifying us that the date of ship's leaving dock having been still further postponed, the boiler fires would be drawn that evening, and for the future, current—from the shore—would only be available for lighting purposes. Here was another facer. However, more time being now given us we started in and stripped the motor bare to the casting. How this was done and all put together again with no assistance from the ship's company, in a place below the water line, as dark as a coal mine, often the sole light being that from a tallow dip, with insufficient head room and floor space, absolutely beggars description. The whole frightful experience lingers in the writer's mind as a hideous nightmare.

The plan was to take ashore everything portable and bake it in the dockyard drying oven. We soon found that the armature, which had a very long spindle, was too long to pass up the ladder way and turn out through the opening or doorway, at the top, so it had perforce to be dealt with on the spot.

We procured an empty packing case just long enough to take the body of the armature, the spindle sticking out through slots at each end. This case could just be squeezed through the doorway and down into the compartment without an inch of room to spare.

To provide room for the armature case, we had, after opening the machine, to disconnect the hinge and remove the movable half of the frame to another part of the compartment. The armature was then lifted into the case, six or eight 50-C.P. lamps were laid upon iron plates along the bottom corners of the case, the brush gear, brush leads, terminal bars, &c., were packed away in odd corners, the lamps connected up to the nearest fuse box, and the cover put on. The six magnet coils were then removed—a man could just stagger under one—and taken ashore, then some distance upon a handcart to the drying stove in which they were left for some days.

We now turned our attention to the main controller, putting charcoal braziers inside, round about, and underneath. Water was again collecting in the compartment, which was now appreciably warm, and the resulting steam was condensing upon the walls of the compartment, which, having cold water at the other side, made an efficient surface condenser, the water running down in tiny rivulets. A gang of cleaners was again set to work, and the cause of the trouble, a centrifugal pump in the corner, having been discovered and the leakage stopped, we finally got rid of the water.

After continuing the baking treatment for about five days we decided to put the motor together again. The field coils had to be brought a distance of about a third of a mile in an open handcart in a drizzling rain, covered with damp sacking. Fortunately we got them down into the now slightly warm compartment before they were cold, consequently they did not sweat. Every single detail—brush holders, brush leads, terminal bars, field coils, cable connections, &c., was separately tested, both before and after fitting into place, and again after connecting up, as the connecting up of any faulty part, however small, would spoil the whole test. How anxiously we watched for the swing of the Megger needle, as each added part was tested. Would it swing to "infinity" or "zero"?

We worked all night hoping to be ready for the official test by the following forenoon, which was Saturday, but as time went on, it became certain that we should not be ready before the testing officer knocked off at noon for the rest of the day. Here was another fix. If the test was left over until Monday, it was highly probable the insulation resistance would be down to zero by that time, unless the motor was nursed day and night until then. However, the testing officer kindly offered to come on board in the afternoon in order to save the situation. We finished at 1 p.m., the motor complete testing out to 10 megohms to earth. An hour later the insulation resistance had dropped 1 megohm. At 3 p.m. when the official test was made, it had further dropped to 8 megohms. The official minimum being two, it was accepted as very satisfactory. The controller being still below the minimum, acceptance was deferred pending further treatment.

The writer was now thoroughly knocked up, added to which a definite date had been fixed for the ship's departure, so that it was necessary to send to headquarters for further assistance.

The remainder of the work, the stripping of the main controller and smaller motor, and baking of the parts, was work of no special difficulty as compared with the other, and calls for no particular comment.

The most exasperating part of the affair was when the

writer, arriving home, luckily alive, was declared by other members of the staff—who know not the delights of insulation tests—to be a lucky beggar to get six weeks' holiday. The writer was 18 months in completely recovering from the said holiday (?).

THE MELBOURNE RAILWAYS ELECTRIFICATION REPORT.

In the report prepared by Mr. Charles Merz in 1908 upon the electrification of the Melbourne Suburban Railways, the whole question of the substitution of electric traction for steam railways was very fully gone into.

At that time, however, the Commissioners did not feel convinced that electrification was justifiable, or that the estimate of traffic increase would be realised. These have, however, already been far exceeded. In 1908 there were about 70,000,000 suburban passengers per annum, the figure for this year will exceed 90,000,000, and in 1917, after electrification, it is estimated that there will be 150,000,000 passenger journeys per annum on the suburban lines. Hence the present proposals deal with this number of passengers, but all parts of the electrification scheme are arranged to be capable of extension from time to time as the traffic subsequently increases.

In order to handle this traffic, it is proposed that the traffic in the mornings and in the evenings, should be provided for by increasing the length of the trains, though it is not proposed to have any longer trains than six coaches to commence with. The scheduled speed, including stops, is 21 miles per hour.

With a view to enabling the Government to decide finally which system is more suitable for the Victorian Railways, complete alternative schemes were prepared by Messrs. Merz and McLellan, and public tenders were invited by the Agent-General in Europe upon them. Offers were received from all the leading manufacturers of the world who prepared detailed proposals accompanied by stringent guarantees.

One particular object kept in view in preparing the specifications and in the scrutiny to which they were subject by Mr. Stone, the Government electrician, who has been collaborating with Mr. Merz in London, was that the resulting comparison should be perfectly fair to the rival systems and the different makers. The fact that no criticisms were put forward by the exponents of either system would indicate that they were fair to all parties.

The present report is divided into three parts, the first part dealing with the choice of system for the suburban lines; the second part dealing with this choice as affected by the country lines, and the third part dealing with the cost of converting suburban lines on the system recommended, and the financial results to be expected from electric working. The suburban lines comprise some 150 route miles, including the lines to Sandringham, Frankston, Dandenong, Ringwood, Eltham, Reservoir, Fawkner, Broadmeadows, St. Albans, and Williamstown. The cost of converting these lines on the direct-current and single-phase schemes amount to £2,349,437 and £3,057,024 respectively, on the basis of the best tenders for each scheme. These figures exclude only those items of capital expenditure which would be unaffected by the choice of systems, as, for instance, the steam-raising plant, the building of the power-house and the repair shops. Hence it will be seen that the single-phase system is more costly than the system recommended, by £707,587. In the same way, a comparison between the working costs of the two systems shows the single-phase system to be more costly by £70,567. More important still, the direct-current system will show increasing advantage over the single-phase system as the traffic increases year by year. Hence, it is obvious that the Government has little choice, and it is certainly satisfactory that the tenders should have such a decisive result.

Although, however, the direct-current system is the more suitable for suburban lines, some doubt existed as to which system would prove the better when electric traction came to be extended to country lines. Comparisons for typical country lines were, therefore, made, and the case of the Melbourne, Woodend and Bendigo line is analysed by Mr. Merz in his report.

The initial cost of converting this line on the single-phase system is more by about £13,000 than on the direct-current system and the annual working cost is also more (some £1,600). These differences are small, but tend to increase as traffic grows. From this it is obvious that the direct-current scheme, which shows such large advantages over single-phase for the suburban system, proves quite as suitable for country lines, such as the Bendigo line, 100 miles in length.

The system to be adopted having thus been definitely settled by the results of the tenders, the report deals with the actual cost of converting the suburban lines and the financial results of so doing. The average speed of the trains is to be increased by nearly a third, and the frequency of the trains by a very large amount. It is estimated by the Commissioners that in 1915 the cost of operating the suburban system by steam will be £360,431 per annum, while electric working will cost £235,416, making a saving of some £125,000 a year in working expenses alone, apart altogether from any increase of revenue. There will, of course, be a very large increase in traffic as the result of electrification, but as it is impossible to tell exactly what this will be, depending as it does so much upon the general prosperity of the city and the State, the profits which will accrue from the electrification with different increases of traffic are given. Mr. Merz estimates that the increases will not be less than 25 per cent., and may very possibly be more; even with this figure the suburban railways will show an immediate profit (after paying interest and sinking fund on all outlays) of £287,674 per annum, in addition to all the other advantages of electrification. The Report has been considered in detail by the Victorian Commissioners, and presented to the Government.

Power will be supplied from Yarraville, in the form of three-phase alternating current at 25 cycles per second, the pressure being 20,000 volts, and will be transmitted partly by underground cables, partly by overhead wires to 12 sub-stations at various points on the system where it will be transformed down, and converted to direct current at 1,500 volts. Overhead wires are to be used throughout the system for the supply of current to the trains. These will consist of units, each consisting of one motor coach and one trailer coach, the length of train varying from two to six coaches. The complete scheme includes the provision of 500 motor coaches, each carrying a four-motor equipment, and 450 trailer coaches.

The single-phase scheme which was compared with the direct-current scheme just described and proved more costly, included the generation of three-phase current at 25 cycles and 20,000 volts, and its distribution to various points on the system at which the current would be supplied to the trolley wires as three separate single-phase currents, the pressure between the trolley wires and the running rails forming the return circuit being 11,000 volts. The make-up of the trains and their schedule speed and carrying capacity would be the same as in the other scheme.

The capital expenditure is estimated as follows:—By 1913, £500,000; by 1914, £1,200,000; by 1915, £1,700,000; by 1916, £2,200,000; by 1917, £2,450,000; by 1918, £2,600,000; by 1919, £2,676,360.

We may add that our readers were informed in our issues of October 11th (page 575), and November 8th (page 744), that the direct-current system at 1,500 volts would almost certainly be adopted.

LEGAL.

Charge against an Electrician.

In the Southern Police Court, Dublin, last week, Wm. Willoughby, an electrician, was charged on remand with having fraudulently converted to his own use electrical fittings, &c., to the value of £5, or thereabouts, entrusted to his charge at Kingsbridge Station by his employer, Mr. J. C. Meldon, contractor, South Anne Street. The prisoner was further charged with having obtained, between January 1st and July 18th, the sum of £33 from Mr. Meldon by means of forging the names of men alleged to have been employed on jobs to time sheets.

For the defence, it was asserted that it was a custom for the defendant to take jobs and do them in his spare time, and that the goods he took were debited him by Mr. Meldon.

Edward Meath, cashier in the employment of Mr. Meldon, stated that the time sheets, from which he had made out the men's wages, were given to him by Willoughby. Willoughby handed him sheets which were in respect of the two men—Brennan and O'Toole—who were supposed to be employed on the Kingsbridge Station job. From these sheets the witness made out the men's wages, which amounted to £15 10s. in respect of Brennan, and £8 4s. in respect of O'Toole. He gave the money to Willoughby to be paid to the men. On July 16th Willoughby brought him two sheets, one for Brennan and the other for O'Toole, and at the same time told him that he was going to pay off both men. The witness asked Willoughby for the men's insurance cards, and said he would not pay anyone unless they had insurance cards. The prisoner said that he had not the cards, but would tell the men to get temporary cards, and to come to the office for payment. Up to the present neither of the men had come to claim his wages.

A number of other witnesses having given evidence to the effect that there were no men named Brennan and O'Toole employed on the Kingsbridge job, the prisoner was returned for trial to the City Sessions, on bail.

Gott *v.* Veritys, Ltd.

(*Continued from page* 785.)

On the 13th inst., Mr. Vachell, for the defendants, contended that, upon the face of the agreement, there was no obligation undertaken by the defendants to manufacture and sell. The whole of their rights to the sole privilege of manufacturing and selling depended upon their giving active operation to the patents. It was for them to say whether they would manufacture and sell, and by the action of the agreement if at any time they did not do so the plaintiff's rights revived. He pointed out that these were joint patents in which every penny of expenditure had come out of the company's pockets. The misfortunes of Mr. Gott had been those of many other patentees. Other people had brought competitive articles in the market at such a cheap price that Mr. Gott's articles—excellent in their principles, no doubt—had ceased to be of practical

use by reason of their expense. The conduct of the defendants had been this: in trying to keep their position in the market and compete successfully with others, they had put plaintiff's inventions on one side, and had ideas and specifications for other appliances which they found they could produce at a cheaper rate.

Giving evidence, the chairman of the company, Mr. G. H. Verity, said that, in his conversations with Mr. Gott, cheapness of construction of articles was very much in the forefront. He found that, so far as the starters designed by Mr. Gott were concerned, the firm's prices were too high. With regard to controllers made especially for an Admiralty contract, it was found, after the drawing got to the practical stage in the workshop, that the cost was very much higher than originally contemplated. There was never any desire, in substituting another article, to do Mr. Gott an injury. The Admiralty bought very keenly.

Mr. Vachell: Just of late.

Witness: No, they always have done so.

On Monday, in the High Courts, Mr. Edward Pollock delivered judgment. He said the plaintiff's case was that it had been agreed that the defendants should manufacture and sell certain patented articles, of which Mr. Gott was the inventor, and pay him the royalties. The claim had set forth that it was a further term of the contract, that, in the event of Veritys desiring to discontinue the manufacture and sale of the articles, they should give plaintiff three months' notice to that effect. It was alleged that the defendants did not give the desired notice, but had allowed the patents to remain as live patents on the market. The articles in question were starters and controllers. The defendants had paid into Court the whole of the amount of the royalties due to Mr. Gott under the contract with him. They had in addition paid £5 into Court. In his opinion that amount was quite sufficient to cover any damage sustained by Gott, and there must be judgment for the defendants in consequence. Defendants would have to pay the costs up to the date of payment into Court, the plaintiff to pay the costs after the payment in, except as to the issue regarding proof of liability on the contract apart from issues raised by amendment.

Gery *v.* Day Motor Co.

(*Continued from page* 784.)

Further cross-examined, plaintiff said he did not demand that the engineer should light the house direct from the dynamo, despite the fact that the number of lights would greatly vary. He expected to have his house efficiently lighted, whether the lights were coupled direct with the dynamo or through the cells. In other words, he wanted a plant according to the specification.

Mr. Bertram Augustus Evans, chief electrician to the firm of Messrs. Furneaux & Thomas, electrical engineers, of Swansea, gave evidence with regard to tests he had made of the plant in question; he described them as unsatisfactory.

Cross-examined, Witness admitted that in one of his reports he described the voltage as steady on that particular occasion. It was true that if the voltage were steady the engine speed must be also steady. He was very surprised when he examined the plant to find that no means had been supplied for running the lights direct off the dynamo.

Mr. Colefax, K.C. (for defendants): The practice of running the lights direct off the dynamo is resorted to mostly in cases of factory and shop installations, where you have a fairly steady load?—Yes.

Do you know of any case of coupling the lights direct with the dynamo in plants for private house lighting?—Oh, yes.

In such cases, is not the dynamo generally a compound-wound machine?—Witness replied that in some cases it might be so. He would not necessarily advise a compound-wound machine for private house lighting; on the contrary, he might install a shunt-wound machine with commutating poles.

Re-examined, witness said the dynamo in question was designed to run direct, but there was no switch arrangement to allow it to do so. When he tried to charge the batteries, he found it was impossible, and he had to shut down after attempting it for five minutes, because the fluctuation in the readings was so great it was impossible to tell what current was going into the cells.

Mr. Arthur Roscoe Furneaux, senior partner in the above-named firm, also gave expert evidence. His firm, he said, had had a fairly large experience of private house lighting installations. In January of this year he was called in by plaintiff to test the plant in question. He ran the engine on a light load with paraffin, and found a speed variation of from 550 to 900 revolutions in two minutes. He then proceeded to apply the specification test. He connected the dynamo up to a water resistance and created a load of 55 volts, 28 amperes; with these readings (he used his own instruments), the engine speed fluctuated between 930 and 950 revolutions. He then reduced the load to approximately 22 amperes, and the speed of the engine immediately rose to 1,050 revolutions. Even using dead-beat instruments, he found very great difficulty in taking a perfectly accurate reading owing to the fluctuations. He also tried running the lights direct, but without switching in or out any of the lights the lamps "jumped." It would be impossible to sit in a room and read by them. He then connected up the cells and tried to charge them for 20 minutes, using the meters provided on the switchboard, but he found the needles varied so much that it would be impossible to form any idea of the amount of current going into the batteries. In his opinion the plant was not an efficient one for the purpose for which it was required.

Further examined, Witness said he knew it was the practice with certain leading firms of dynamo makers to supply shunt-wound dynamos with commutating poles for the purpose of running direct on to the lights. This machine was of that type, and therefore he was justified in assuming that this machine ought also to run direct. The difficulty with this plant was the inefficiency of the engine governor.

Cross-examined by Mr. Walker (with Mr. Colefax, K.C.), Witness said that Messrs. Siemens Bros. had orders to supply him with a shunt-wound machine fitted with commutating poles for running direct on the lights, and they guaranteed its satisfactory working. The Westinghouse Co. also made a similar machine. He did not think the 6 per cent. variation specified was excessive.

When the dynamo is being used with a low voltage, the magnetic field is greatly weakened?—Yes.

And in your test you worked on a low voltage?

Witness admitted that that was so.

Mr. Walker then opened the case for the defence, and said defendants never agreed to supply a dynamo which would run direct on the lights, and their evidence would show that the machine in question was not designed to do so. The reason why plaintiff tried to run it in that fashion was because the batteries had been smashed up, owing to the negligence of plaintiff's people. They had coupled them up in such a way as to short-circuit them and render them utterly useless. When the plant was delivered, it was in a thoroughly sound condition, and no complaint was made with respect to it until it had been in the hands of plaintiff's people for some little while.

Mr. Joseph Day, managing director of the defendant company, then gave evidence, and said he was the inventor of the two-stroke system of engine, such as was supplied in this instance. There were many more engines sold throughout the world working on that principle than on the four-stroke principle. This particular class of engine was frequently supplied for electric lighting work in cases where the load was constant. Continuing, witness described the interview with Mr. Brown at the premises of the Electrical Federation, which ultimately led to the order being given. It was always intended that the plant should be run with the batteries. Not a word was ever said about lighting direct with the plant. He did not mind which plaintiff had, in fact, he would just as soon have fitted him out with a direct-running plant.

George Venn, mechanic in defendants' employ, gave evidence to the effect that when the plant was first installed he went down and ran the engine for some 48 hours, charging the cells. It ran very well, and Mr. Gery expressed his satisfaction. He handed it over to the plaintiff. Later, in consequence of complaints, he went down to see the plant and found that the engine was not in the condition in which he left it. Parts had been altered; for instance, the commutator had been put into a lathe and filed down.

Mr. Francis Hird, departmental manager to Messrs. Siemens Bros., stated that he had examined the dynamo in question, and in his opinion it was not a suitable machine for direct lighting purposes. It was possible to use a shunt-wound dynamo with commutating poles for direct lighting purposes, but he was not aware that it was the practice of his firm to make such machines, especially for direct lighting. It was news to him that Mr. Furneaux had ordered such a machine from his company for that purpose. The machine supplied to plaintiff was obviously to be used for charging batteries. If the engine when it was first installed satisfactorily charged the batteries for 40 hours, there was no reason why it should not continue to do so.

Mr. Albert Edgar Fleming, in defendants' employ and the engineer in charge of the plant in question, described the charging test, &c., when the plant was installed, and said plaintiff then expressed himself as very well satisfied.

Mr. Edward Cutting, of the firm of Messrs. Cutting Bros., dynamo and motor engineers, of Stamford, Lincs., gave evidence, and stated that his firm supplied the generator in question. It was a shunt-wound machine, and was not the type of machine to be used for direct lighting. It was a commutating-pole dynamo, designed to prevent sparking when giving an increased amperage output working on a weakened field. The dynamo supplied was perfectly efficient for battery-charging purposes, and was a standard type manufactured by his firm.

Mr. Frank Broadbent, consulting engineer, also gave expert evidence in regard to the plant. He said that by the specification, to his mind, it was clearly intended that a plant for lighting off the batteries and not for direct lighting should be supplied. The dynamo was not constructed for direct lighting.

This concluded the evidence, and counsel then addressed the Referee upon the whole case.

Judgment was reserved.

The Telephone Arbitration.

(*Continued from page* 784.)

Dealing with contractors' charges, including the charge made by sub-contractors, Sir J. Simon contended that here again the figures of the company were wrong. He claimed that the Post Office figures for labour were confirmed by a great body of practical testimony from contractors and others. In regard to the percentage to be allowed for contractors' supervision, the question arose as to whether there ought to be anything allowed for storage. The provision made by the Post Office for contractors' profit was ample, because it was not usual to allow contractors' profit upon materials supplied when the contractor was himself supplying the materials. He submitted that the evidence given on behalf of the Post Office as to that was overwhelming, and it had not been challenged on the other side. It did not matter whether they were

dealing with overhead wires or underground cables, the question of supervision of labour was not affected in any way by the purpose for which the work was intended. Supervision was not a function of time, although it might be regarded as a function of labour and materials. Whatever they regarded it as, so long as the work was carried out under normal conditions, time did not affect the question of materials and labour. They had the experience of judges of all sorts that 21 per cent. was a right percentage for this head. It was not a question of the ratio of salary to time. If they did the thing 12 times as fast, they paid out the wages 12 times as fast, but still they paid out the same amount.

SIR J. WOODHOUSE said that if the work were done in a shorter time, it did not follow that the wages would be the same, because it might involve night work, which was more expensive.

SIR J. SIMON agreed that under those circumstances the wages account might be higher, and as a consequence, the percentage of the cost of supervision to the cost of labour would be lower. His contention was, however, that 21 per cent. for supervision was a proper figure for a normal rate of construction.

The SOLICITOR-GENERAL having concluded his arguments so far as the contractors' evidence and the re-instating cost were concerned, said he would next have to deal with the employers' burdens, the checks, and the depreciation. The question then arose as to the probable duration of the proceedings, and Sir John said he thought he would be able to finish the depreciation case in a day, and if the Court adjourned until Monday, he hoped to be able to conclude his speech on Tuesday.

MR. DANCKWERTS, K.C., said that if the question of land and buildings were gone into, it would take about 80 days more.

The SOLICITOR-GENERAL: I am glad to say that that part of the case is in the hands of the Attorney-General.

MR. DANCKWERTS asked as to the remaining branches of the case, said that he was unable to make a definite statement as owing to thunderclouds in the air he had been unable to confer with the Attorney-General.

MR. JUSTICE LAWRENCE said that when the Court had made up its mind on the first part of the case they hoped it would not be necessary to contest some of the other matters which might be very burdensome to both parties.

On Monday, when the Court resumed after the adjournment on the previous Wednesday, SIR J. SIMON continued to sum up the case for the Postmaster-General on the question of the cost of construction of the company's plant. Dealing with the question of the amount which should be added to the contractors' total charges for employers' burden, in order to arrive at the total of construction, the Solicitor-General said the Postmaster-General had produced a great body of evidence in order to show that 5 per cent. was a proper allowance to make to cover the burdens falling upon the employers' shoulders. Under this heading the company charged 10·835 per cent. He submitted that it was impossible to contend that the Postmaster-General's figure of 5 per cent. was "grossly insufficient," inasmuch as it was based on sound judgment and experience. On a 5 per cent. computation the total sum for this item amounted to no less than £578,000. Proceeding, Sir John next dealt with the question of the increased cost consequent upon the work of obtaining wayleaves, and the expediency of taking this item into account in the contractors' totals.

SIR JAS. WOODHOUSE remarked that, the company having no statutory rights, had to arrange for wayleaves, which might have involved an enormous amount of difficulty and correspondence. It was impossible to treat telephone construction too much like tramway construction, because, in the latter case, the works were concentrated, and they were bound to take into account the cost, &c., of obtaining wayleaves.

SIR J. SIMON said he agreed there were special difficulties in that respect, but he submitted that the work of obtaining wayleaves was not part of the contractors' business. It was the employers' business, and, therefore, should figure as a special item of cost.

(*To be continued.*)

BRADFORD STRIKE PROSECUTION.—"PERSISTENT FOLLOWING."

A CASE of considerable interest to employers and employés in the electrical engineering trade came before the Bradford Stipendiary Magistrate (Mr. H. W. W. Wilberforce), at the Bradford City Police Court on Thursday last, when Lional Barker, of 34, Napier Street, Bradford, and Atkinson Pinder, of 29, Springfield Street, Bradford, were summoned at the instance of Arthur Arrowsmith, of 6, Cross Street, Leeds, "in that they, with a view to compelling the complainant to abstain from doing an act which he had a legal right to do, to wit, working as an electrician's labourer at the New Picture House, Thornton Road, Bradford, did unlawfully and wrongfully and without legal authority persistently follow him." The complainant was represented by Mr. Alex. Neill, whilst Mr. W. Trenholme appeared for the defendants, who both pleaded not guilty. The prosecution was taken under the Conspiracy and Protection of Property Act, 1875.

MR. NEILL said that he ought to mention that a strike of electricians had been proceeding in Bradford from October 12th right up to the present time. The complainant was employed on work at the New Picture House, Thornton Road, and on the evening of October 25th the two defendants were waiting outside the Picture House, evidently with a view to speaking to complainant, and endeavouring, by peaceful persuasion, to get him to come out on strike. When complainant left his work that day he was met by a hostile crowd numbering some 50 or 60 persons who followed him to the car, booing and calling out "Blacklegs!" to him and his companion. The police were amongst the crowd in good numbers, and two constables escorted complainant and his friend to the car. When the car was reached, a section of the crowd endeavoured to board the car with the complainant. Amongst those who succeeded in their object were the two defendants, and during the journey they tried to persuade him that he had no right to work, and he (Mr. Neill) suggested that they also terrified the complainant. Bills were distributed amongst the people on the car, which showed clearly what the object of the defendants and their fellows was. The contents of the bills were: "Bradford Electricians' Dispute. Fellow Workers,—A few men, known as blacklegs, are assisting the employers to try and defeat the legitimate demand of the men for better conditions. We therefore ask you to assist us in clearing this dangerous element from our path. Our fight is yours. To-morrow it might be your turn. Workers of the world, unite." He (Mr. Neill) said that the intention of the two defendants was, that by persistently following, they expected to be able to compel the complainant to leave his work.

The complainant corroborated Mr. Neill's statements, and said that the defendant Pinder said to him that he was no man, and a blackleg. He (complainant) asked how he could be a blackleg when he was not an electrical engineer, but only a labourer, and he was then charged with doing electrical work.

Cross-examined by MR. TRENHOLME, complainant stated that there was no actual demonstration against him, and that he was not afraid of the strikers individually. He thought there would have been some trouble if the police officers had not been present. He would not get any higher wages if the electricians succeeded in getting what they demanded. He had been followed by other strikers since October 25th, who gave him to understand that they intended getting him out, and would give him a good hiding when they got the chance.

P.C. SHAW and P.C. MCCLINTON said they accompanied the complainant from his work to the car, and travelled with him to the terminus. They gave evidence as to the methods used by the strikers who were in the car to try to get the complainant out on strike, and stated that the strikers were getting so excited that they had to warn them to be careful what they said. The arguments were used in a menacing sort of way, and could not be described as quite peaceful.

INSPECTOR CHALLONER corroborated the statements of the constables.

MR. TRENHOLME said that under Sec. 2 of the Trades Disputes Act the defendants were quite entitled to do what they had done.

The STIPENDIARY MAGISTRATE asked what necessity there was for such a number of strikers to board the car if it was only for peaceful argument with the complainant.

MR. TRENHOLME said there was no evidence that the defendants had spoken to the complainant at all. Also, there was no evidence whatever that any attempt had been made by the defendants to compel the complainant to abstain from work.

The STIPENDIARY MAGISTRATE: It is ridiculous to suggest that there is no tittle of evidence of compelling action.

The Defendants gave evidence to the effect that only peaceful persuasion was used by the strikers during their conversation with the complainant, and they parted quite good friends.

FREDERICK WILLIAM HORSFALL stated that he was with the complainant when he was followed, and he had decided to relinquish his work the following day.

The STIPENDIARY MAGISTRATE asked if the Trades Union would undertake not to follow, in the manner in which they had been doing in this case, during the continuance of the strike.

MR. TRENHOLME, after consultation with the Union, said that they would be prepared to give such an undertaking as was desired by the Stipendiary Magistrate if there would be no conviction.

The STIPENDIARY MAGISTRATE said he could not enter into any bargain of that sort. He was anxious that the dispute should be conducted in a proper manner. He suggested that the Trades Union should undertake "That no persons in the employment to which this dispute relates shall be followed, except by members of the Strike Committee authorised to discuss the matter." This would extend to any person deputed by the Strike Committee to discuss the subject.

MR. TRENHOLME said that his clients would agree to the undertaking as suggested by the Stipendiary Magistrate, and the case was thereupon adjourned for a fortnight.

BUSINESS NOTES.

The Price of Aluminium.—It is reported from Berlin that a meeting of the International Aluminium Syndicate was to have been held on November 14th to discuss the situation of the market and make an advance in prices. The price until recently has been M. 80 (£4) per cwt, but the metal has not really been obtainable at this quotation for some time past, charges of £4 5s., and even up to £4 10s., having to be paid for small parcels. The active demand is attributed to the increasing use of aluminium for domestic utensils and for military purposes by army authorities, who are adopting the metal to a growing extent for field flasks and articles of war. Since these lines were written, it has transpired that no decision was reached at the conference which was held in Paris. The minimum consequently remains at £4 per cwt., but will be increased when the price actually obtained exceeds the minimum by 15 per cent.

Canadian Duty on German Wire Lamps.—It is reported from Berlin that the Government of Canada has introduced special duties on certain goods of German origin as from November 1st, these including Wolfram lamps. The imports of these lamps from Germany have hitherto been treated, it is said, "fairly uniformly with French and Dutch products," but British lamps enjoy a preference of 5 per cent. Now Canada has imposed a special duty on German lamps, and it is thought possible that the business of some makers will thereby be disturbed. It is understood, however, that this does not affect the German Incandescent Gas (Auer) Light Co., as the company avails itself of the English Welsbach Co. for exports to Canada.

Constantinople Troubles.—It is stated that considerable losses have probably been incurred by the Ganz Electricity Works Co. and the Hungarian General Credit Bank or its associated electrical trust in connection with the various lighting and traffic enterprises in Constantinople, in consequence of the reported destruction of many cables in the Turkish capital. The representative of the Ganz Co. in Constantinople has reached Buda-Pesth to give particulars of the situation.

For Sale.—MESSRS. P. HUDDLESTON & Co. will, on November 26th, sell by auction, at 56, Redcliff Street, Bristol, a large quantity of electrical apparatus, &c. See our advertisement pages to-day.

Consular Notes.—Norway.—The British Consul at Christiania, in a recent report, states that the total imports of machinery into Norway in 1911 were valued at £1,149,350. The following are the details of the principal machinery imports by countries of purchase :—

Motors, steam, water, gas or petroleum.—From Germany, £36,000 ; Sweden, £53,000 ; United Kingdom, £3,000 ; U.S.A., £18,000 ; Denmark, £30,000.

Other machinery (except agricultural).—From Germany, £385,000 ; Sweden, £44,000 ; United Kingdom, £108,000 ; U.S.A., £54,000 ; Denmark, £25,000.

Parts of machinery.—From Germany, £219,000 ; Sweden, £33,000 ; United Kingdom, £26,000 ; U.S.A., £6,000 ; Denmark, £12,000.

Compared with the corresponding returns for 1910, the above figures represent a loss to British trade of about £1,000 under the heading of motors. British motors unfortunately seem to find little demand in Norway as compared with those of Sweden, Germany, Denmark and the United States. A reference to statistics of past years points to the fact that it is chiefly Sweden and Denmark who have wrested from us the market, which eight years ago was worth some £20,000 to British exporters. General machinery and parts of machinery from the United Kingdom showed a satisfactory advance in 1911. The reason for the loss of trade in motors is probably to be ascribed largely to the cheapness and suitability of the Scandinavian motor, especially as auxiliary motors for the fishing vessels and pleasure motor-boats. Some British firms have tried to get their marine motors introduced, but it is believed that their efforts have not met with any measure of success, and there would seem to be but little opening at present for British steam, gas, electric or petroleum motors.

Later in his report, the Consul states that one or two British firms have acted on the suggestions made in last year's report as to the possibilities of trade by post with Norway. There is another point which has occurred to him which might conduce to the general advantage of British traders and to the help which the Consulate can give to inquirers. British firms are constantly applying to the Board of Trade Commercial Intelligence Branch or to the Consulate for the names of suitable agents to represent them ; but it hardly ever happens that a British firm afterwards notifies to the Consul the name of the agent actually selected, and the Consulate is thus left uninformed as to the names of a large proportion of the local agents of the British firms he is there to assist. In such circumstances it is obvious that there can be little co-operation between agent and Consulate in the interests of British trade ; in cases of commercial failures, happily rare of late years, the Consul does not know the names of the probable British creditors whom he can warn in time to safeguard their interests, and it may happen that fresh applicants may be supplied with the names of local agents who already represent competing British firms. The Consul would, therefore, gladly welcome any notification of the names of local representatives of British firms, and would be pleased if British commercial travellers going to Christiania would call at the Consulate during their stay.

Canary Islands.—The American Consul reports that the local telephone company, which is Swedish, is considering the installation of a new and modern system. The present line runs from Teneriffe to Laguna and Tacaronte, with about 300 subscribers on the books in Teneriffe and 100 in Laguna. The tram company was recently affiliated under the name of the Compania Electrica Industrial de Teneriffe with the electric light company, which a short time ago extended its service to Laguna, and now supplies the light for both cities from a greatly enlarged and modern plant completed in 1911. Electricity is used almost exclusively for lighting, except by the poorer people, though the wealthier people living in the country have their own acetylene gas plants.

The past year saw an improvement in the service of the German-South American Cable Co., partly perhaps because of the completion of the new wireless company. The various cables from the Canary Islands have been laid since 1884. In that year the Spanish National Submarine Cable Telegraph Co. obtained a 10-year concession from the Spanish Government to lay the first island cables between Cadiz and Teneriffe (860 miles), Teneriffe and Las Palmas (57 miles), Teneriffe and La Palma (69 miles), and Las Palmas and Arecife, Lanzarote (164 miles). Upon the expiration of this concession the Spanish Government took the lines over, and has since worked them through a Government staff. In 1908, new cables between all these points were laid to replace the old lines. In 1885 an English company laid a cable from Teneriffe to St. Louis, Senegal (896 miles), under a 15-year concession from the Spanish and French Governments in agreement. Upon the expiration of this concession the company dissolved, after previously handing over the cables to the French Government, which subsequently transferred its holdings to the South American Cable Co., Ltd., to be used as an extension to its regular system from Pernambuco to Dakar. The St. Louis station thereupon was closed and the terminus of the old Teneriffe line moved to Dakar. Messages for Europe and North America by this cable now go *via* the Dakar-Brest cable. In 1909 the German-South American Telegraph Co. laid a cable under a 50-year contract with the Spanish Government, assisted by liberal German Governmental support, between Teneriffe and Emden, and in 1910 another cable between Teneriffe and Monrovia, Liberia. The latter has since been extended from Monrovia to Pernambuco. The rates per word to Europe or North America by the German-South American Co. and by the Government cable are practically the same.

The Marconi Wireless Co. has completed and put into operation its installation, after a considerable delay in fulfilling the stipulations of the Spanish Government. While this company will compete with the cable company, there is no anticipation of war between them. Where similar service can be performed by each the rates are similar. The four towers are each 185 ft. high.

China.—The American Consul at Tientsin reports that the telephone mileage in Tientsin on December 31st, 1911, was 2,122, and number of stations 1,831—increases of 40 miles and 33 stations in 12 months. The figures for Tientsin will be practically stationary for the present year, owing to the fact that the switchboard is filled, and there can be no increase in number of stations until the entire telephone system of the city is rebuilt. It was intended to undertake this work as soon as possible this year, but even though the new material were ordered immediately the new system could not be in operation until some time in 1913. In Peking on December 31st, 1911, there were 2,136 telephone subscribers, an increase of 505 in 12 months, while 1,434 miles of bare wire and 5,056 miles of cable core were in use. The unsettled condition of business at present and the lack of capital alone prevent a very great increase in the use of the telephone. The Chinese in Tientsin and Peking thoroughly understand the advantage of telephonic communication, and it is only a question of time, plus normal business conditions, to witness an extraordinary development. The trouble in this country is the lack of long-distance lines, the longest at present being about 120 miles.

Catalogues Wanted for Malay.—MR. C. HARCOURT STEVENS, chief engineer, Sempam electric power station, Tras, Pahang, Federated Malay States, asks us to state that he will be pleased to receive price lists, pamphlets, &c., from manufacturers of general station appliances, lighting accessories, and complete petrol-electric sets (small).

Winter Resort.—We have received a copy of the official illustrated booklet issued by the Falmouth Corporation, bringing before the public the suitability of the climate and resources of that resort for winter visitors.

Catalogues and Lists.—MESSRS. ELLIOTT BROS., Century Works, Lewisham, London, S.E.—Three new lists as follows :—No. 51 (20 pages) concerning D.C. switchboard instruments, moving coil and soft iron types ; No. 56 (16 pages) relating to various patterns of portable instruments for C.C. and A.C. ; and No. 57 (16 pages) devoted to testing sets. All of the lists contain specification information, with illustrations and tabulated particulars and prices.

MESSRS. BERRY, SKINNER & Co., 78, Upper Thames Street, London, E.C.—Leaflet respecting the "Pygmy" electric heater.

MR. G. BRAULIK, 8, Lambeth Hill, London, E.C.—Illustrated and priced leaflets ; No. 37, "Eclipse" intense flame arc lamps ; No. 37A, semi-enclosed arc lamps for D.C. ; one relating to the double-carbon flame lamp for D.C. or A.C. ; also the first part of a Christmas list of electrical novelties.

MR. G. WILKINSON, Beech Mount, Harrogate.—Pamphlet containing brief particulars of the "Losles" system of steam pipe drainage and a selection of testimonials from electricity works engineers who have had experience therewith.

MR. O. N. BECK, 11, Queen Victoria Street, London, E.C.—Priced leaflet relating to rope and chain steel protectors for hoisting and transporting work.

THE UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—A 52-page booklet entitled "The Book of the Excello," being a semi-technical treatise on the "Excello" flame arc lamp, in which a good number of night photographs are included showing the lamps in actual use. Contractors can have copies on application.

THE TURBO-ELECTRICAL CO., 25, Victoria Street, London, S.W. —Sixteen-page illustrated pamphlet describing high lift centrifugal pumps, and showing some examples of their applications in mine drainage, shaft-sinking, public water supply, boiler-feeding, and other service.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich.—A very fine instrument catalogue (No. 508) of about 250 pages. The book is, we believe, the most complete and comprehensive catalogue of measuring instruments that we have seen, and must have involved a large amount of labour and expense in its production. Attention may be directed to a few special lines, namely, moving coil and dynamometer type instruments for laboratory purposes, combina-

tion sets of instruments, a special astatic wattmeter which has great sensitiveness at very low power factors, a line of electrostatic voltmeters for pressures up to 150,000 volts, the Siemens-Blondel oscillograph, and to a wide range of rheostats, but there are doubtless numerous other manufactures in the work which would also interest our readers. There are in all some 15 sections, but the book requires to be seen for its completeness to be fully appreciated.

MESSRS. EUREKA PUMP CO., 53, Bothwell Street, Glasgow.—Catalogue No. 214 (60 pages), containing full descriptive particulars and excellent half-tone views and line diagrams of their various designs of Eureka steam pumps and power pumps. Some useful information and tables of interest in such a connection, and the Eureka Telegraphic Code, occupy the last 16 pages. We understand that the works of the company have been running night and day for the past 18 months, and extensions are in hand to enable them to cope with orders. The London office is at 25, Victoria Street, S.W., under the management of Mr. Philip S. Doherty, late of the Worthington Pump Co. The company also has offices at Newcastle, Cardiff and Manchester, and agents in many foreign countries.

MESSRS. CLARKE, CHAPMAN & CO., LTD., Victoria Works, Gateshead-on-Tyne.—A number of catalogues containing full and illustrated information relating to their manufactures, including Woodeson's water-tube boilers and direct-acting steam pumps.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Leaflet giving particulars and prices of a heat indicator in the form of a paint, which they are now introducing under the name of "Detectheat." This well-known method of detecting hot bearings is very effectual; a sample, consisting of a piece of metal painted with the detector can be had on application.

THE ARMORDUCT MANUFACTURING CO., LTD., Farringdon Avenue, London, E.C.—New priced leaflet relating to "Guttaflex" patent rubber-cord armoured flexibles, of which large stocks are carried.

THE CAMBRIDGE SCIENTIFIC INSTRUMENT CO., LTD., Cambridge.—An excellent pocket-size catalogue (No. 102) of about 120 pages, wherein their wide range of electrical instruments are particularised with neat illustrations, and very clearly indicated prices. The contents include galvanometers, oscillographs, electroscopes, and electrometers, resistances, bridges, potentiometers, and so on. Several pages contain a complete list of code-words, and net weights in tabulated form.

Trade Announcements.—MESSRS. WATLINGTON AND CO., LTD., are carrying a stock of 100,000, not 10,000, Britannia lamps, as we understood last week. Their number in Milton Street is 48, not 43.

THE ACTON LAMP CO., LTD., have just removed their head office and sales department to the works at Agnes Road, Acton, W., with a view to centralising their business. All communications should be sent to that address.

MESSRS. IMESON, FINCH & CO. (1912), LTD., of Bridge Works, Stockton-on-Tees, have just recently purchased from the liquidator of Messrs. Traction Supplies, Ltd., of Sunderland, the full patent rights and stock for "Whites" two-way reversible and renewable finger. The firm are now fully equipped for the manufacture of these goods, and indeed for any tramway material.

New premises at 6A, Parade, Canterbury, have been opened by MR. L. A. WELLS, electrical engineer.

MESSRS. HUTTON BROS., electrical engineers, of Swindon, have removed their business from Commercial Road to the Quantock Works, Devizes Road.

MESSRS. PONTELEC WELDING PATENTS, LTD., have removed to larger premises at 46, Constitution Hill, Birmingham. Their new telephone number is "Central 4413."

Bankruptcy Proceedings.—JOSEPH ARTHUR PROCTER, Bradford, warehouseman, late electrician.—This debtor attended at the County Court, Manor Row, Bradford, on November 13th, for his public examination on accounts showing a deficiency of £113. It transpired that the debtor started business, without experience, in 1909 at Frizinghall, with a capital of just over £9. He attributed his failure to under-estimating and want of practical knowledge. The case was declared closed.

HARRY THORPE and H. J. SALTER (trading in co-partnership as Thorpe & Salter, electrical engineers, High Holborn, W.C., and Holloway). Also Harry Thorpe (separate estate).—In both cases, a first and final dividend of 20s. in the £ and 4 per cent. interest is payable after November 23rd at Carey Street, W.C. This was a 1905 failure. (See ELECTRICAL REVIEW, August 4th, 1905, p. 177). Congratulations!

FRED. SHAW, electrical contractor, Hull.—A supplemental dividend of 4s. 6½d. in the £ is payable November 26th, at York City Bank Chambers, Lowgate, Hull.

ALFRED SITCH, metal-worker and electrical engineer, Brecknock Road, London.—An order was made on October 22nd, suspending discharge for two years.

Book Notices.—*The Teaching of Electric Light Switching.* London: A. P. Lundberg & Sons.—This booklet is addressed to teachers in technical colleges, &c., and is intended to draw their attention to the importance of a competent knowledge of the "Art of Switching." To this end, various methods of teaching the art are mentioned, and particulars are given of the demonstration boards and other aids to lecturers obtainable from the publishers.

"*Annuaire* du Bureau des Longitudes." 1913. Paris: Gauthier-Villars. Price 1 fr. 50.

"Handbuch der Elektrizität und des Magnetismus." By Prof. Dr. L. Graetz. Leipzig: Johann A. Barth. Price M. 13.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXI, No. 2. November, 1912. New York: The Institute. Price $1.

"An Outline of the Metallurgy of Iron and Steel." By A. H. Sexton and J. S. G. Primrose. Manchester: Scientific Publishing Co. Price 12s. 6d. net.

"*Proceedings* of the Rugby Engineering Society." Vol. IX, 1911-12. Rugby: The Society. Price 10s. 6d. net.

"*Calendar* of the University College, University of London." 1912-13. London: Taylor & Francis.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Part 1, 1912-13. Glasgow: The Institution.

"Practical Measurements in Radioactivity." By W. Makower and H. Geiger. 1912. London: Longmans, Green & Co. Price 5s. net.

"*Transactions* of the Illuminating Engineering Society." Vol. VII, No. 7. October, 1912. New York: The Society. Price 75 cents.

"Design of Electrical Machinery." Vol. III. Alternators, Synchronous Motors, Rotary Converters. By Wm. T. Reyson. 1912. London: Chapman and Hall, Ltd. Price 6s. 6d. net.

"Light: Its Use and Misuse." New York: Illuminating Engineering Society.

"*Proceedings* of the Engineers' Club of Philadelphia." Vol. XXIX, No. 4. October, 1912. Philadelphia: The Club.

"*Journal* of the American Society of Mechanical Engineers." November, 1912. New York: The Society. Price 35 cents.

"*Transactions* of the University of Toronto Engineering Society." Vol. VI, No. 6. October, 1912. Toronto: The University.

Electrical Trades Union.—We are asked to state that owing to the requirements of the Insurance Act and the growth of membership, the general office of the Electrical Trades Union will be removed to more commodious premises at 137, Great Clowes Street, Broughton, Manchester, where all communications should be addressed on and after December 1st.

Liquidations.—BRYANT TRADING SYNDICATE, LTD.—A petition for winding up, presented by Mr. A. Rosenthal, Finchley Road, London, a creditor, is to be heard on November 26th.

BRITISH HOSIERY AND ELECTROLYTIC BLEACHING CO, LTD.—This company is winding up voluntarily, with Mr. De Westley Layton, 167, Fenchurch Street, E.C., as liquidator. Creditors must forward particulars of debts, &c., by December 31st.

LIGHTING and POWER NOTES.

Accrington.—Speaking at the starting of Messrs. Boardman & Baron's new cotton mill at Clayton-le-Moors, Mr. Boardman said it was only by the merest chance that the new mill was not equipped with electrical instead of steam driving. The Accrington Corporation was asked what it could do for the firm, but it was not at that time in a position to supply all the current that would have been needed—hence the adoption of the older method. Had the Corporation been only a little more advanced with its electricity extensions, then it was possible the new Royal Mills, with its 1,008 looms, would have been the first in that district to be completed without chimneys.

Argentina.—The San Cristobal (Santa Fé) municipality has granted a concession for an electric light station to J. A. Aguirre. The concession and contract are for 25 years.

The Victoria municipality (Entre Rios) has been calling for tenders for public lighting by means of 136 arc lamps, for a period of ten years.—*Review of the River Plate.*

Atherton (Lancs.).—The U.D.C. has decided to apply to the L.G.B. for sanction to borrow £1,300 to meet further outlay in providing transformers, switchgear and pillar-boxes.

Australia.—The Petersburg Corporation (S.A.) is taking the initial steps in connection with the installation of a municipal electric supply. The scheme is estimated to cost £6,000. The Railways Department has agreed to take 50,000 units per annum, at 4½d. per unit, required for the local workshops equipment.

A poll of the ratepayers of Albury (N.S.W.) has been taken with respect to the proposal that the local Council should be authorised to borrow £105,000 for the purpose of installing an electric light and power plant, and resulted in favour of the scheme.

The North Sydney Council held a special meeting to consider the report of Mr. G. A. Julius, consulting engineer, who was commissioned to inquire into the various offers to provide electric lighting in the municipality. In his report, Mr. Julius favoured the proposal from the Sydney City Council, but recommended the offer of the Northern Suburbs Electric Light and Power Corporation, because it included the destruction of garbage, which he had been given to understand was essential. The discussion, which was a long one, showed a feeling that the expert had been hampered in his report, and eventually it was decided that Mr. Julius be asked to report fully on the various schemes submitted, independent of any instructions he may have received, and, if necessary, to confer with the Works Department in regard to the proposals from that department.—*Australian Mining Standard.*

Billericay.—The R.D.C. has appointed a committee to consider the advisability of having the new hospital lighted by electricity instead of by petrol-gas.

Birmingham.—An excellently-produced and well-illustrated 26-page booklet, entitled "Electricity in the Modern Home," has been issued by the electric supply department. The pamphlet explains in simple language the applications of electricity in the different sections of the home, the various apparatus in use being illustrated by well-drawn pen-and-ink sketches with suitable legends. The concluding pages refer briefly to electric cooking and general domestic work, and end with a few paragraphs dealing with the terms of electricity supply. This production should appeal strongly to the better-class residents of the city.

Cambridge.—The Cambridge Electric Supply Co. has been approached by some residents of Godmanchester, Hunts. (about 14 miles distant), as to the possibility of a supply of electricity for that district, and the adjoining town of Huntingdon has been asked to participate in a scheme. Discussed at the Huntingdon T.C. meeting, it was decided that the Council could not take any part in the scheme, but it would offer no opposition to a company furnishing a supply. The population of Huntingdon is between 4,000 and 5,000, and of Godmanchester about 2,000.

Cheltenham.—During the present week a "Modern Home Exhibition," which gives every promise of success, has been held at the Town Hall. Primarily, the idea is to illustrate the domestic and other uses of electricity, the price of which has recently undergone considerable reduction. The central feature of the Exhibition is a fully-furnished miniature villa, which is used to demonstrate electrical applications in the home, and in addition some 40 well-known electrical firms are exhibiting lighting, heating and cooking appliances. In the restaurant a well-known local firm of caterers is using a complete equipment of electrical cooking apparatus, and elsewhere the general traders of the town have a number of exhibits on view. The "Modern Home Electrical Bulletin," printed in the Exhibition, tells one all there is to know about the Exhibition, and sufficient to interest us in the possibilities of the apparatus displayed there. In organising the Exhibition, the Electricity Committee joined forces with Mr. Cecil Gill Smith, who has had previous exhibition experience, and Mr. W. J. Bache, the borough electrical engineer, and Mr. Smith, whose joint endeavours have resulted so successfully, are to be congratulated on their work.

Continental Notes.—GERMANY.—The German city of Stuttgart, which has hitherto been without the modern illuminant, now proposes to make up the deficiency by taking a supply of current from the projected Murg Valley station, to which it stands nearer than Mannheim, the original objective of that plant.

The Murg Valley hydroelectric scheme, which is the most important, as it is the first effort on a large scale to utilise the water powers of the kingdom of Baden, has now been laid before the Landtag by the Government in the form of a draft Bill. The scheme, as previously stated, is estimated to cost some 30,000,000 marks, and will, when fully accomplished, supply power to the extent of 100,000 H.P. The high-pressure current will be distributed by long-distance mains from the station at Forbach to Mannheim, and will be used not only for lighting purposes, but for driving the machinery in the Mannheim railway workshops and at the harbour. The existing steam central stations at Karlsruhe and Mannheim will be incorporated. All political parties are unanimous as to its benefits, so that the realisation of the scheme is assured.

The Government of Baden, with the approval of the Landtag, have organised a department for water powers and electricity. The department will be entrusted with the development of water sources and the drafting of communal and other schemes for the utilisation of public and private water reserves. It will also advise public bodies in their negotiations with private supply companies, supervise current supply contracts, enact regulations against accidents, &c.—*Elektrotechnik u. Masch.*

NORWAY.—The *Industrie Electrique* learns that an important waterfall situated near one of the Norwegian fiords is in the market. It has a flow of 5 cb. metres per second from a height of 865 metres, and will develop 40,000 KW. The station, which may be built on the seashore, at the foot of the mountain down which the water will be conducted, will be well placed for the electric treatment of iron ore, the fiord being accessible to shipping at all seasons.

AUSTRIA.—A Vienna electrical engineering concern is interested in a project to put down a plant to utilise the water of the River Drau at Faal, near Marburg, in the generation of electrical energy for lighting and power purposes. It is stated that no less than 24,000 H.P. will be available.

SPAIN.—A concession has lately been granted to put down a plant to utilise the water-power of the River Noguera Rubagorzano at Traga de Nogueras (Province of Lerida) in the generation of electrical energy for lighting and power purposes in the district.

ITALY.—La Societa Electricita Riviera di Ponente (Negri), of Milan, is increasing its capital from £480,000 to £800,000, with the object of putting down a plant to utilise the water-power of the River Roja in the generation of electrical energy, and for the supply of the same to several sections of the State Railway system which are about to be electrified.

FRANCE.—The capacity of the power station of the Société de l'Energie Electrique du Nord de la France, of Roubaix, is to be increased to 40,000 H.P. by the addition of a new 10,000-KW. steam turbine and dynamo.

Crowborough.—The local gas company is applying for a prov. order for electric light in the parishes of Crowborough, Maryfield, Buxted and Hartfield, and those parts of the parishes of Rotherfield, Withyham, Frant and Speldhurst which are not within a four miles' radius of Tunbridge Wells.

Cwmamman.—The U.D.C. has decided to apply for a prov. order for electric light, and to engage Mr. Higgs, of Swansea, as electrical engineer at £5 per cent. on the outlay. As the result of a canvass, 389 probable private consumers have been secured.

Darton (Barnsley).—At the last meeting of the District Council the matter of the lighting of the township came up for discussion. It was stated that the General Purposes Committee had had a consultation with representatives of an electrical company and a gas company, the former undertaking to supply 154 lamps with electricity to burn 2,000 hours per annum, at a cost of 24s. per lamp per annum, or including maintenance charges, but not broken globes, 13s. to 15s. extra per lamp per annum; the estimated capital cost with overhead wires and a lamp on every other standard was £9 15s. 6d. per lamp for wooden poles, and £13 15s. 6d. per lamp for steel poles. The gas company was prepared to undertake to supply gas lighting, including all maintenance, for an inclusive sum of 35s. per lamp per annum. The matter has been referred from the Council to the Committee, and now resolves itself into a fight between the supporters of electricity and those who support the use of gas.

Darwen.—The new plant being put down at the electricity supply works, under the extension scheme prepared by Mr. C. Garnett, the Council's electrical engineer, includes one 1,250-KW. Dick, Kerr high-pressure turbine, coupled direct to a 3,000-volt three-phase alternator. Also a 300-KW. rotary converter by the British Westinghouse Co. A Rees Roturbo rotary jet condenser of latest type, giving a vacuum of 27¾ in. is to be installed, and a remote-control switchboard by Messrs. Ferranti.

Doncaster.—The T.C. is applying to the B. of T. for an order extending the area of supply under the E L orders of 1898 and 1912 so as to include the Urban Districts of Bentley-with-Arksey and Balby-with-Hexthorpe.

Douglas (Isle of Man).—The Special Electrical Undertaking Committee of the T.C. has recommended the establishment of a public electrical undertaking for the borough on the lines suggested in the report of Messrs. Handcock & Dykes, and that as current must be provided for the Villa Marina for the ensuing season, steps be taken with a view to carrying out a section of the scheme, so as to obtain the necessary supply of current.

Dromore (Co. Down).—A special meeting of Council was held on the 13th inst., for further consideration of the electric lighting scheme. It was explained that the special business was to consider a resolution that the Council should apply for a provisional order. The present system of public lighting was costing the Council £150 a year, representing £3,000 capital. The engineers (Messrs. Millar, Wilson & Pegg) had prepared two schemes, estimated to cost £3,200 and £3,600, and by adopting either the Council might count on a profit of, roughly, £300 a year, after payment of working expenses. On a vote, the resolution was adopted.

Ealing.—The B.C. has instructed the electrical engineer to obtain tenders for the immediate laying down of three new feeder mains, two to the Broadway and one along Mattock Lane, at an estimated cost of £4,000, this amount having already been sanctioned by the L.G.B. in a loan for mains and services; and also to prepare a specification, to be submitted to tender, showing the requirements with regard to the installation of a new switchboard at the works.

The desirability of the Council undertaking the outside lighting of small shops by means of incandescent lamps, at an inclusive price per annum, to include provision of lamps, fitting up, maintenance and supply of current, was fully reported upon by the electrical engineer last week, and a resolution was adopted agreeing to undertake such work at the following scale of charges:—200 C.P., £3 16s. 6d. per annum; 300 C.P., £5 15s., and 600-C.P., £9 13s.

The Chamber of Commerce has resolved to call a special meeting of Ealing electrical contractors to discuss the merits of what is known as the "Ealing clause" in reference to municipal trading, and also the proposal of the Borough Council to establish a showroom at the Town Hall for electrical apparatus. Mr. J. D. Knight, borough electrical engineer, while denying the fact that the Electricity Committee was competing unfairly with Ealing contractors, agreed that it would be very satisfactory to call a meeting and hear differences of opinion that might have arisen as to the "Ealing clause."

Earlestown.—The U.D.C. has decided not to proceed any further at present with the application to the B. of T. for a provisional order for electric light.

Elland.—The D.C. has decided to apply for sanction to borrow £1,000 for the purpose of the electricity undertaking.

Epsom.—With a view to adopting electrical pumping at the waterworks, the U.D.C. has decided to obtain an estimate of the cost of cable, motor, &c.

Felixstowe.—With reference to our note last week, we understand that the Electricity Co. has lost the public lighting, the decision of the Council being to give all the lighting it can to the local gas company at a somewhat higher price than the electric

light tender for a period of seven years. The Electricity Co. is, however, to carry out the lighting of roads within 150 yards of the Promenade, which is, of course, now electrically lighted, this arrangement being part of an agreement with the Council dating from 1903.

Grange (Lancs.).—The U.D.C. has informed Mr. Thomas Wilkinson that it will be prepared to grant him facilities for supplying electricity in the district, subject to the arrangement of terms for the sale of the undertaking at the end of a term of years.

Gravesend.—A L.G.B. inquiry was held on November 12th by Mr. T. C. Ekin into the application of the T.C. for a loan of £10,000 for E.L. purposes, viz.:—Mains extensions, £8,000; house services, £1,200; coal store, £500; automatic stoker, £260; incidental expenditure, £40. A councillor opposed on the ground that too much capital had been expended on extensions to Northfleet.

Grimsby.—The Public Lighting Committee of the T.C. on Monday decided to recommend the installation of additional plant at the electricity works, at an estimated cost of £8,000.

Harold Wood.—The Electrical and Engineering Supplies Co., Ltd., has applied to the Romford R.D.C. for permission to erect electric lamps in the streets at Harold Wood, but the Council has replied that it has no power to grant the application.

Haywards Heath.—The U.D.C., on Monday, decided not to proceed with an application for a prov. order for electric light. This decision has been arrived at after consideration of expert advice.

Herne Bay.—The Gas Co. is applying to Parliament by Bill for powers to take over and work the electric light prov. order obtained by the U.D.C.

Hove.—The General Purposes (Lighting) Sub-Committee of the T.C. recently received a report prepared by Messrs. Handcock & Dykes, on the undertaking of the Hove Electric Lighting Co., Ltd., in regard to which the Council, on November 14th, decided by 17 votes to 16, to give notice of its intention to exercise its powers of purchase. The Hove authorities are at liberty, at the expiration of 21 years, to purchase the undertaking, buildings, works, machinery and plant of the company, either by:—(1) Paying the company the amount of the legitimate capital expenditure of the company, with such sum added as shall, with the profits previously made, and available for distribution as dividends, make up a total cumulative dividend of 7 per cent. per annum on the capital actually received by the company from the shareholders; or (2) on paying for the undertaking by valuation as a going concern, and not subject to the restrictions set forth in the second section of the Electric Lighting Act of 1888, the amount of such capital expenditure, or of such valuation, as the case may be, to be settled, in case of dispute, by arbitration. The original plant consisted of Lancashire boilers supplying steam to high speed engines direct coupled to Crompton dynamos together with a storage battery, the system of supplying being low-pressure direct-current on the three-wire system, the pressure supplied to the houses being 110 volts, or 220 volts between the outers of the mains. This plant has been considerably added to, and during the past year an exhaust steam turbine generator has been added at the Holland Road station. The capital expended on machinery and tools is £53,761, and on electrical instruments (which means practically switchboards and accessories) £2,914. The Holland Road plant, although in good order and capable of good work for several years yet, is antiquated; the Leighton Road station is much more conveniently arranged, and it was evidently intended by the company that it would gradually take the place of the Holland Road station. The maximum load on the combined stations at present is about 1,000 KW., the day-load in the summer falling as low as 70 KW., although it is probable that both figures will shortly be increased. The average cost of coal per unit sold throughout last year was 0·81d. This is a very high figure compared with stations worked with Diesel engines, and having a much smaller output. If the 1,139,328 units sold last year by the Hove Co. had only cost the same price per unit for fuel as at stations using crude oil engines, the total fuel costs, instead of being £3,865, would have been £1,380—a saving of £2,485 per annum. Dealing with new plant, should the Corporation decide to purchase the undertaking, Messrs. Handcock & Dykes recommend putting down Diesel oil-engine driven generators to take the long-hour load, keeping the present steam plant for the peak load, which only lasts quite a short time. They would propose to put in Diesel-driven sets to a total of about 600 KW., which, with the present steam sets, would give a total plant capacity installed of some 2,700 KW., and would meet all probable requirements for some time hence. This new plant should be installed at Leighton Road. The 600-KW. Diesel engines, together with the 490 KW. of condensing engines will take the main load, the Holland Road station being used as a battery sub-station, and to help during the winter peak. It would eventually be shut down as the original plant wears out, the exhaust turbine being then, or at an earlier date, transferred to Leighton Road. To carry out these alterations and additions would cost about £20,000. Assuming that the undertaking were purchased on the basis of "capital legitimately expended," the cost, according to last year's capital account, would be £174,998. In conclusion, and in dealing with the future, Messrs. Handcock & Dykes state that they understand that there are some 1,800 gas lamps in the borough. Should the Council decide to convert these to electricity, and spend the same annual amount for electrical energy that is now paid for gas, it should be possible, with the generating plant that will then be at their disposal, to give a somewhat improved public illumination, and, as a result of the increased output from the electric light works, to make a further reduction to the private consumers of 0·25d. per unit or more. Further than this, there is the question of electric traction within the borough. If this matures it would certainly be more advantageous financially both to private consumers and to the traction undertaking to supply energy for this from their own station than to keep the two separate, more especially as a multiplicity of generating stations in one compact area is not advisable. Electric cooking and heating would also provide a new source of revenue.

Ilford.—The U.D.C. has refused its consent to an application by the County of London Electric Supply Co., Ltd., for a prov. order to enable it to supply current in bulk in the district, and will oppose the application.

India.—Messrs. Crompton & Co. have entered into a contract with the Nagpur Electric Light and Power Co., for a complete plant to generate and supply electricity in Nagpur. Steam is to be generated by three Babcock water-tube boilers having a capacity of 5,000 lb. of steam an hour. The generating plant will consist of three Crompton direct-current dynamos, coupled direct to Belliss engines, two of 100-KW. output each, and one of 50 KW.—*Indian Textile Journal.*

A scheme is on foot for establishing a hydro-electric power station between Candy and Colombo, for the purpose of generating electric power in bulk for both industrial and traction purposes. Mr. H. R. Speyer, consulting electrical engineer, has been retained for formulating a scheme.—*Indian Engineering.*

Isle of Thanet.—The Westgate-on-Sea and Birchington Gas Co. is applying for powers to supply electricity in the parishes of Westgate, Birchington, Acol and St. Nicholas-at-Wade, all of which are in the area of the Isle of Thanet R.D.C.

Leeds.—The revenue returns for the half-year ending September 30th show that 9,628,779 units were sold as against 6,573,365 in the corresponding period of 1911, the revenue in the two cases being £46,047 and £39,097. Deducting working expenses ·48d. per unit as against ·52d., and the proportion of capital and interest charges in each case, there remains a deficit of £6,189 for the summer six months of 1912 as compared with a deficit of £7,200 for the corresponding period of 1911—the deficit during this period being, of course, more than covered by the larger returns of the winter months. The private lighting sales are now increasing normally, and the revenue shows an improvement of 7·3 per cent.; for power 6,213,824 units were sold at an average of ·188d. per unit, the motors supplied aggregating over 20,000 H.P. The motor units have increased from 306 to 325 per connected H.P. in the last half-year. A new item in the sales is 1,605,176 units to the tramways department, at the low figure of ·30d. per unit.

The Parliamentary Committee of the City Council has decided to recommend the Council at its next meeting to leave out of the Parliamentary Bill application for powers to acquire a new site for a new electricity generating station. The Committee also recommends that the clause seeking powers to run a railless trolley system of cars to Crossgates should also be omitted, and, therefore, the route will finish at Halton.

Liverpool.—In view of the importance of the electrical work and the small amount of time which could be devoted to it at the fortnightly meetings of the Committee, Councillor Gates suggested at the meeting of the Electricity Committee on Friday that a Sub-committee be formed to meet fortnightly alternately with the general body. They were, he said, faced with considerable developments electrically in the near future. Liverpool afforded great opportunity for the supply of electrical energy for power and lighting on a larger scale. It was decided to defer the matter for a week, to give time for consideration.

London.—STOKE NEWINGTON.—As from March 31st last the charge in respect of steam supplied by the refuse destructor for the generation of electricity is to be at the maximum rate of £1 per 1,000 units for all low-tension units delivered at Edward's Lane station—the minimum charge is £10 per quarter for water consumed—and the payment of the balance between such minimum and maximum rate to be subject to deduction of the extra cost of the bulk supply, consequent upon failure of the steam supply from any cause, each quarter to be calculated separately.

Newport (Mon.).—A L.G.B. inquiry was held on November 14th by Mr. T. C. Ekin into the application of the T.C. for a loan of £3,220 for electricity purposes. There was no opposition.

New Zealand.—The Whangarei B.C. has at last received the report of Mr. E. Parry, chief electrical engineer of the Dominion Public Works Department, on the proposal to generate electrical power by utilising the Wairua Falls. Mr. Parry is of the opinion that the Wairua Falls are capable of developing up to 1,500 H.P. without any outlay for storage of the waters, the only work necessary being to divert the river into a race. Mr. Parry has calculated that the construction of a race pipe-line, generating station, the transmission of the power to Whangarei, and its distribution for industrial purposes in the neighbourhood, would involve an outlay of £82,000. An annual revenue of £10,540 would, he considered, be required to defray expenses. Further, Mr. Parry estimates that a charge of £7 per annum would be the minimum rate

at which power could be supplied in the bulk to power users. Consequent upon this information, the Whangarei B.C. intends to go into the matter again.—*Australian Mining Standard.*

Northwich.—The Weaverham Electricity Supply Co., Ltd., of Northwich, is giving formal notice of its intention to apply to the B. of T. on or before December 21st next under the Electric Lighting Acts, 1882 to 1909, for a prov. order authorising it to supply electricity for all public and private purposes in the parishes of Weaverham-cum-Milton, Acton, Cuddington and part of Oakmere, all in the Northwich rural district.

Peterborough.—At a recent meeting of the T.C., the electrical engineer submitted comparative data in respect of a turbo-generator and a Diesel generator for proposed extensions. He recommended the former, and was instructed to submit particulars as to the extension with that plant.

Port Glasgow.—Terms between the Greenock and Port Glasgow Corporations for a supply of electricity for all purposes to Port Glasgow have been signed. Greenock Corporation will give an immediate supply to large power users in Port Glasgow.

Shipston-on-Stour.—The B. of G. has referred to the House Committee the question of having the electric light installed at the Workhouse. Messrs. Brown & Parsons, of Leamington, who are carrying out a scheme in the town, have offered to lay the main to the gates of the institution free of charge.

South Africa.—An Oudtshoorn syndicate has acquired some 100,000 acres of land adjoining the Orange River, and it is stated intends to utilise the falls of the river in hydro-electric development, with a view to electric pumping for irrigation, and for driving flour mills. According to a local paper, the Durban T.C. has been subjected to considerable criticism, because after initiating low tariffs for electric cooking purposes, and inducing consumers to adopt the new charges, it has now been found that the Council has no powers to secure a supply of cheap electrical ranges to be let out on the hire-purchase system, as was intended. Consumers will, therefore, have to secure their apparatus from electrical storemen, in regard to whom it is alleged that prices are kept unduly high. It has been arranged, however, for the Corporation to finance consumers, the hire-purchase system being continued, and apparatus will be supplied by contractors, who will give a two-year guarantee.

Sunderland.—At the recent L.G.B. inquiry in connection with the Council's application for the sanction of the Board to the borrowing of £37,207 for the purposes of the electrical undertaking, the Inspector suggested that the Council carefully consider a scheme by which the balance of the outstanding loans on the disused steam generating plant should be paid off at an earlier date than is provided for in the original sanctions. The Committee has given this matter very careful consideration, and recommends that the Board be requested to give its approval to the sale of the disused plant upon the following terms:—The proceeds of the sale, together with the interest thereon, to be paid into a separate "superseded plant account," until such time as the balance of the outstanding loans have been met. After reserving 20 per cent. to form a reserve or contingency fund, the net profits of the undertaking to be allocated to the credit of the "superseded plant account." This arrangement to be for three years, and to come up for reconsideration at the end of that period. The report of the Committee was adopted.

Taunton.—The T.C. has decided to purchase about 20 sets of electric cookers and apparatus for hiring out at rentals based on 10 per cent. per annum on the net cost.

The question of opening electricity showrooms and offices in the town has been deferred for a year.

Truro.—Sitting in committee on November 12th, the T.C. decided to apply for its own prov. order for electric supply.

As has been stated in the Electrical Review, orders are being applied for by the Gas Co. and others.

Wakefield.—It has been decided to utilise the tramway poles on Doncaster Road and Barnsley Road (by agreement) for carrying cables in connection with the supply of electricity to Belle View and Sandal.

Willesden.—A request for a supply of electrical energy for 250 H.P. was recently received by the Council in a portion of the district where no distributing cables were laid capable of dealing with such a demand. Estimates were prepared and submitted to the Electricity Committee, who decided to recommend to the Council the extension of H.T. mains and the erection of a temporary substation to deal with about four times the amount of the demand received. The Council met, confirmed the Committee's recommendation, and the plant was ordered within 10 days of the request being made. Something over 3 miles of H.T. cable was laid, and a 300-KW. rotary converter delivered 8 weeks later. This plant has now been put into operation, and is intended to supply energy for the new factories which are being built in the Park Royal district, where a number of valuable sites are still available. We congratulate the Council and its engineer, Mr. A. W. Blake, on this smart performance

Worcester.—After holding two special meetings to consider the proposals of the city engineer in regard to the electricity undertaking. The Electricity Committee has decided that application be made to the L.G.B. for sanction to borrow £7,400 for extending the boiler house at Hylton Road Station and providing a steam turbine and alternator. The total amount required is £7,650, which is made up as follows: Extension of boiler house, £1,200; extension of bunkers and coal-handling plant, £500; mechanical stoker for Powick boiler, £200; steam piping, valves, &c., £150; induced draught plant, £250; steam turbine-driven 1,000-KW. two-phase alternator, condenser, and necessary foundations, £5,100; new fittings for Powick boiler, with removal and re-erection, to be paid for out of revenue, £250.

Last May, the Council agreed to take over from Messrs. Heenan and Froude, 15 motors for £200. The Committee has now sanctioned an arrangement whereby 10 of these, of 195 H.P., are to be exchanged for 10 new motors of 240 H.P. from the Electric Construction Co., the Council paying the company £200.

TRAMWAY and RAILWAY NOTES.

Argentina.—The Lomas Municipality has given its sanction to the concession for the construction of an electric tramway in Lomas, the concession being for 20 years.—*Review of the River Plate.*

Australia.—According to *The Standard*, Mr. Merz has been asked by the Western Australian Government to give his views on the development of the Perth tramway system. After an examination of the question, Mr. Merz has advised that certain extensions to the tramways should be made, and that a power station to supply energy for both tramways and railways should be established.

Birmingham.—The City Council has decided that application be made to the Light Railway Commissioners for an order under the Light Railways Act, 1896, authorising the construction and working by the Corporation of a light railway, joining up the Halesowen light railway, with the line from Balden Road to Bearwood, sanctioned by the order of the Corporation obtained this year.

Brighton.—It is proposed, on the recommendation of the Tramways Committee, to make provision in the Corporation Parliamentary Bill for power to equip railless traction routes from St. George's Road, *viâ* Montague Place, to Kemp Town Goods Station entrance.

Clydebank.—After negotiations lasting several years, the plans for tramway bridges over the Forth and Clyde Canal at Dalmuir and Kilbowie have been passed by the Dean of Guild Court. Of the expense to be incurred, Glasgow Corporation pays £11,000.

Continental Note.—Germany.—A scheme is at present under consideration for the construction of an electric railway between Griersdorf, Arnsdorf and Steinseiffen, Silesia.

East Kent.—The B. of T. has confirmed the order made by the Light Railway Commissioners authorising the construction of light railways from Wingham to Stodmarsh, and from Great Mongeham to Ripple in the new colliery area.

Folkestone—Sandgate.—The National Electric Construction Co. has approached the Folkestone T.C. and the Sandgate U.D.C. on the question of the construction of tramways or a railless traction system. Both Councils have decided not to consider any scheme by which overhead wires would be used.

Halifax.—The Tramways Committee has decided to introduce a motor-'bus service between Mytholmroyd and Cragg Vale within five weeks of the date of the Royal Assent to the Bill, which it is promoting in the next session of Parliament. From Councillor C. W. Greenwood the Committee has received an offer of a personal guarantee of £100 through the Mytholmroyd D.C. Should there be a loss the service will be continued until the £100 is exhausted.

Huddersfield.—The Corporation has approved of the tramway extension scheme from Elland to West Vale. A subcommittee has been authorised to confer with the Elland D.C. in regard thereto, and application is to be made for the necessary Parliamentary powers. It has also been decided that in the proposed Bill, powers be inserted for the running of railless trolley vehicles from the present terminus at Outlane to the borough boundary.

Ilford.—A report upon the desirability of applying for powers to extend the electric tramways through the Cranbrook and Grange Estates is to be prepared by the tramways manager.

Keighley.—The T.C. has discussed the recommendation of the Tramways Committee to accept the offer of the Trackless Trolley Co., London, to construct overhead equipment for the proposed railless traction system from Ingrow Bridge to Haworth, at a cost of £1,610. A resolution of acceptance was carried.

Leith.—The Provisional Order for the new Lothians (electric) Railway is now prepared. It is on a more ambitious scale than the previous one, which was dismissed earlier in the year. A syndicate of coalmasters and others are promoting this new railway, with the main object of getting direct and quick service from the collieries in Mid and East Lothian to the docks at

Leith. A departure has been made in the drafting of this Provisional Order now in hand by meeting objections that the new line would be practically a private line. It will in addition to working the coal traffic also take passengers and goods. The principal line will be from the fishing village of Cockenzie to Leith Docks; and there are mapped out six branches or short communication lines to collieries off the main route. The plans, therefore, are on a larger scale than the previous proposals debated before a Committee of the Lords in the spring of this year, when the preamble of the Bill was found not proved. Electric power is to work all the traffic, and this will necessarily be on an important scale. This new Lothians Railway will compete with the North British Railway.

Lepton (near Huddersfield).—The U.D.C. has appointed a deputation to interview the Huddersfield Tramways Committee, to ascertain whether the Committee would be prepared to extend its tramways to Grange Moor.

Liverpool.—The new type of double-deck electric tramcar, designed for the use of the Corporation service by Mr. C. W. Mallins, general manager of the tramways department (already described in the ELECTRICAL REVIEW), was inspected on the route on Friday last by the Tramway Committee, and is understood to have given general satisfaction. The feature of this car is that a separate entrance and exit are provided, with two staircases running in opposite directions for ingress to and egress from the upper deck. A barrier rail divides the incoming and outgoing passengers, and also forms a recess for the conductor to stand in, with suitable checking apparatus for the collection of fares.

London.—According to the daily papers, the Metropolitan District Railway is to undertake alterations and improvements at Earl's Court Station, in connection with which the Ealing electrical services will be operated in future without obstructing those to Wimbledon. The estimated cost of the work is £70,000.

London Railway Amalgamation.—It is officially announced that the Central London and City and South London tube railways will in future form part of the Underground Electric Railways system, and that arrangements have been concluded between the Metropolitan Electric Tramways, Ltd., the Tramways (M.E.T.) Omnibus Co., and the London United Tramways, Ltd., for the consolidation of the interests of the shareholders in these companies by the formation of a new company, and also by the London General Omnibus Co. for the control of the 'buses of the Metropolitan Co. By this scheme the underground obtains control of the only two unabsorbed electric tube lines in London, but parts with the management of the London United Tramways, which, under the proposed amalgamation with the Metropolitan Tramways, will be under the management of Mr. James Devonshire.

In the circular issued to the City and South London shareholders, it is pointed out that that line is suffering severely from competition, and that the board has agreed to promote a Bill in the next session of Parliament for the widening of the tunnels and the provision of the necessary capital for the work, and for new rolling stock and electrical equipment. It is stated that the new concern will control capital of over £23,000,000.

Some of the clauses of the Metropolitan Railway Bill are of interest, having regard to its acquisition of the Great Northern and City tube. It is proposed to make a connection between the latter and the Metropolitan Co.'s Liverpool Street station, and an extension to Princes Street, where the Waterloo and City tube would be joined, the South-Western Co. being associated with the Metropolitan in the scheme.

Morocco.—Application has been made for a concession to construct and work an electric tramway in the town of Melilla.

Nottingham.—The Corporation is promoting in Parliament this month a Bill authorising an extension of its running powers outside the city boundaries. Under the scheme provision is made for the introduction of an electric 'bus service for West Bridgford, and, in view of the Royal Show in 1915 at Woolaton Park, the laying of a tramway in Derby Road as far as Woolaton Park Gates.

Stirling.—The directors of the Stirling and Bridge of Allan Tramways, one of the few systems still relying on horses, are at present considering the adoption of a system of mechanical traction. According to Mr. Brand (Glasgow), the chairman, they have not arrived at any absolutely definite result, and are still negotiating with companies and makers of mechanical traction machines which they think will suit them better than new tramcars. Last year's traffic receipts were £4,542.

Tasmania.—The Bill which was to have enabled the Hobart City Council to take over the tramway service of the Hobart Tramway Co. was rejected in the Legislative Assembly by 15 votes to 13, there being a strong feeling that the Government and not the City Council should own the tramways.—*Australian Mining Standard.*

TELEGRAPH and TELEPHONE NOTES.

An All-British Atlantic Cable.—On Friday last Mr. Charles Bright, F.R.S.E., gave evidence before the Royal Commission on the resources of the Empire as to the necessity of a State-owned Atlantic cable, connecting the United Kingdom with Canada, and so with the Pacific cable to Australia and New Zealand. He also advocated the provision of cable communication with the Cape landing only on British territory, pointing out in each case the strategic importance of national control in time of war. Wireless telegraphy should, in his opinion, be used as an auxiliary means of communication between the different parts of the Empire. As was well known, the use of cipher codes for the purpose of ensuring secrecy was quite ineffective.

Australia.—The wireless telegraph stations at Fremantle and Port Adelaide were opened for public service on September 30th.

France.—A small wireless installation suitable for an aeroplane, and actually used with success during recent French army manœuvres, seems worthy of serious attention. It is made on the Rouzet system, by the Soc. Industrielle de T.S.F. et Elec and using high-frequency current produced on a new principle, gives superior results, being exceedingly regular in working, with reduction of weight and bulk. A biplane fitted with this equipment can maintain communication with a station on the ground while circulating around it aloft to distances embraced by a radius of 100 kilometres. It draws only 250 watts from the motor driving the biplane, and weighs no more than 30 kg.—*L'Industrie Electrique.*

German Islands.—A wireless scheme to link up the islands of the Bismarck Archipelago with Sydney has been arranged, and the first instalment of the plant has reached Rabaul, in New Britain. The station will be on the Telefunken system, and will be of high power, capable of calling up the Pennant Hills station near Sydney, or Yap, in the Caroline Islands.

Germany.—The German cruiser *Göben*, at Constantinople, is said to be in wireless communication not only with wireless stations in Germany, such as Norddeich, on the coast of East Friesland, but also with the flagship *Deutschland*, in home waters.

Imperial Wireless System.—As briefly mentioned in our last issue, on Wednesday last week the evidence of Mr. Beech Thomson, president of the Federal Wireless Telegraph Co., of America, was taken by the Select Committee on the Marconi Agreement. He said they were transmitting on the Poulsen system 2,000—2,500 words daily from San Francisco to Honolulu, with 24 KW. They began this service on October 20th this year. In the daytime they could work over 1,400 miles. His company had developed several valuable patents since it commenced operations, and very important improvements had been made in the last six months. If the negotiations in progress with the English company were concluded, it would have the right to use the patents worked by his company in America. He had refused to make any contract with the United States Government until the system was perfected. The continuous wave that his company was using was more reliable than the spark system. He admitted that the United States Government had made no contract with the company, and that its future relations with that Government depended entirely on whether the Government was satisfied with the working of the instruments when they were installed. After 8.30 a.m., the signals from Honolulu grew faint. He had not been in America since October 20th, when the regular service was first established. His system was not the same as that which was offered to the British Government by the Poulsen representatives. The Marconi Co. had brought two lawsuits against his company, which were still pending.

On Thursday Mr. Thomson was further examined, and said he was certain he could give a reliable 24-hour service over 2,000 miles. He would be prepared to erect 6 stations round the world, 2,000 miles apart, within 8 months, all in working order. He stated that American wireless experts held that if the art had not been controlled by Marconi greater progress would have been made; that the spark system on which Marconi was working could never be developed for high-class work, and that the damped-wave theory contained unlimited possibilities. The group of men with whom he was associated represented a capital of at least 100 million dollars. They would have been glad to tender for the chain of Imperial stations at £60,000 per station on the basis of "no play no pay," giving a 24-hour service. The capital of his company was five million pounds. He refused to produce a balance-sheet and to answer questions about his company's capital.

On Monday Sir D. de V. Graaff, Minister of Posts and Telegraphs of the South African Union, gave evidence on behalf of his Government, which, he said, was in complete accord with the Imperial Government on the subject, and cordially approved of the arrangements that had been made. His Government attached great importance to the fact that the Marconi Co. alone was carrying on a continuous long-distance service, and would not take part in any scheme which involved experiments and delay. The experts in South Africa stated that the Marconi system was the only one that could cover the distances. After hearing Mr. Thomson's evidence, he certainly would not support the giving of the contract to his company under the present conditions. It was the strategical aspect of the scheme that interested his Government. He hoped there would be a double wireless connection with South Africa—on the west coast as well as the east. Asked whether it would be

reasonable for the Government to suggest that the Marconi Co. would not be allowed to use their patents unless they agreed to terms dictated by the Government, the witness said certainly not. After having heard Mr. Thomson's evidence, he was more than ever disposed to give the contract to the Marconi Co.; Mr. Thomson's system was still "in the air."

Sir Alex. King was recalled, and said that the probable revenue per station was estimated to be over £31,000, making for the six stations about £200,000 a year, on the assumption that there was sufficient work to occupy the stations 24 hours a day at the specified rate. He vehemently protested against the manner in which he was questioned by one member of the Committee—as though he were a prisoner—and repeated that to say to the company "if you do not accept our terms we will not give you any licence" would have been dishonest.

Japan.—An official of the Japanese Department of Communications has been appointed to visit Great Britain, to investigate works connected with electricity and Post-Office work.

Norway.—The Government has approved of the agreement between the Norwegian Telegraph Bureau and the Marconi Co. for the establishment of a long-distance wireless station.

South America.—Wireless communication between Lima, on the west coast, and Para, on the east coast, has been successfully established across South America by the Berlin Telefunken Co. The whole distance is 2,113 miles across virgin forest, the Andes, nearly 20,000 ft. in height, intervening. Telegrams handed in at Lima are sent by wireless direct to Manaos, a distance of 1,367 miles, and thence again by radio-telegraphy to Para, a distance of 745 miles.—*Australian Mining Standard.*

United States.—The wireless station erected by the United States Navy Department at Fort Meyer, Arlington, Va., which, when completed, will represent an investment of over £200,000, was tested on the night of October 28th, when messages were sent to the Key West and Colon stations. It is expected that the station will possess a sending radius of 3,000 miles under ordinary weather conditions. Its most striking feature is the three steel towers, connected at their tops by a series of 23 wires, from which the messages will be radiated and received. The towers are arranged 400 ft. apart at the corners of a triangle around a central receiving and sending station. The westernmost of these towers is 600 ft. high and 150 ft. square at the base, while the other two towers are 450 ft. high and 120 ft. square at the base. The wireless equipment in the station, although built especially for the navy, is not entirely new, having been in use at the Fessenden station at Brant Rock, Mass., in 1910, where it was subjected to exhaustive tests for a period of over eight months. The equipment comprises a 100-KW. motor-generator set, energy for driving which is purchased from the Potomac Electric Power Co., of Washington. At the end of the motor-generator shaft is a synchronous rotating spark-gap.—*Electrical World.*

Wireless in War.—It is stated that the Turkish wireless station near Smyrna was destroyed by the Italian cruiser *Pisa* on April 20th, and spectators declare that about 200 shots were fired for that purpose. As a consequence, no radiographic station on the coast is in the hands of Turkey in the present war, though the Turkish warships are partly equipped with old types of Marconi apparatus. Shortly before the outbreak of the present war, the Ottoman Government obtained two modern portable stations on the Telefunken system, and these were at once dispatched to the scene of operations. On the other hand, the Balkan States have provided themselves with a sufficient number of portable stations on the Telefunken, Marconi, and Poulsen systems, together with plant made by the Société Française Radioelectrique, of Paris. The stations at Athens and Varna, which are equipped with the new type of Marconi apparatus, are able to communicate with one another, and their range extends over the whole of the scene of war. It is said that these two land stations are of special importance for the co-operation of the land and naval forces, as 13 Greek warships are fitted with apparatus of the latest type, and wireless stations are also installed on most of the Greek and Bulgarian merchant steamers. The range of the ship stations is such that the vessels are able to get into communication with the land stations at Athens and Varna at any time.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—November 25th. Six electrically-worked luggage lifts for the Aberdeen Joint Station Committee. Engineer, Mr. J. A. Parker, 80, Guild Street, Aberdeen.

Austria.—DROHOBYCZ.—November 30th. Tenders are required for the supply for the year 1913 of the following materials: 500 metal-filament lamps, 350 carbon lamps, 3,500 arc lamp carbons, 200 kg. of plain copper wire, 500 m. of insulated copper wire, 200 m. of lustre wire, 100 porcelain insulators, 10 electric hand-lamps, and 100 safety switches. Further particulars of the Direktion der K.k. Mineralöl Fabrik, Drohobycz, Austria.

Ayr.—The T.C. invites tenders for the supply of about 220 tons of steel grooved tramway rails and fishplates. Mr. J. Young, Town Buildings, Ayr.

Australia. — SOUTH AUSTRALIA. — December 11th. Line material (Schedules 250-252), and submarine telegraph cable and cable tank, for the P.M.G.'s Department. See "Official Notices" November 1st.

December 18th.—Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" November 8th.

December 17th.—Three sections of common-battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" October 25th.

VICTORIA.—December 31st. Thirty detectors, for the P.M.G.'s Department. See "Official Notices" to-day.

January 24th, 1913. Two 4,000-KW. steam turbo-alternators, for the Melbourne City Council. See "Official Notices" to-day.

NEW SOUTH WALES.—December 11th. Telegraph cable, for the P.M.G.'s department. See "Official Notices" November 1st.

Tenders were recently invited by the Sydney Municipal Council for the installation of a storage battery in the neighbourhood of King and Macquarie Streets. The invitation has temporarily been withdrawn, but tenders will be again called for in the near future. —*Tenders* (*M. and E. Review*).

Balderton, Notts. — December 14th. The Parish Council invites tenders for an electrical installation for street lighting, consisting of the necessary lamp standards, posts, overhead conductors, incandescent fittings, insulators, brackets, &c. Particulars from the Clerk, Balderton Parish Council, 7, Osborn Terrace, Balderton, where a complete plan, showing the proposed positions of all lights and course of cable, can be seen by appointment.

Belgium.—November 26th. La Société de l'Exposition de Gand, 1913 (Rue des Moineaux), Ghent, is inviting tenders for the installation, maintenance and working during the period of the Exhibition, of the pumps, electric motors and piping required in connection with the cascade in the Court of Honour.

Birmingham. — November 25th. Electric motors (various), for the City Electric Supply Department. See "Official Notices" November 8th.

Brussels.—Offers required for the supply of telegraph cables and fittings. The special terms are contained in form No. 1,189, to be had on application. Deposit 1,300 fr. Musée Commerciale, Brussels.

Dartford.—November 27th. 500 yd. of concentric lead-covered and armoured cables and accessories, and renewal of lighting battery, for the U.D.C. Electricity Department. See "Official Notices" November 15th.

Eastbourne.—December 16th. 99 long-burning flame arc lamps for street lighting, and purchase of 99 open-type double-carbon lamps to be displaced, for the Corporation. See "Official Notices" to-day.

Edinburgh.—November 23rd. Electric lighting installation at the Store Cattle Byres, Cattle Market, Georgie. Specifications, &c., at Engineer's Office, Dewar Place, Edinburgh (deposit £1 1s.).

Gravesend.—December 2nd. High-tension cables, for the Corporation. See "Official Notices" to-day.

Halifax.—December 3rd. Two water-tube boilers, with superheaters and mechanical stokers, for the Corporation Tramways and Electricity Committee. See "Official Notices" to-day.

Hungary.—December 31st. The municipal authorities of Perjamo (Torontal Komitat) are inviting tenders for the establishment of a central station for the supply of electrical energy for public and private lighting and power purposes in the town.

Leeds.—December 2nd. Electrical equipment required for combined centrifugal sewage pumps. Mr. G. A. Hart, Sewerage Engineer, 26, Great George Street, Leeds. (Deposit £10, returnable).

London.—HACKNEY.—December 12th. Open type and flame arc lamp carbons, for the B.C. See "Official Notices" to-day.

New Zealand.—December 16th. Two 150-B.H.P. Diesel engines, two 100-KW. dynamos, balancer, motor-generator, switchboard, crane and oil tanks for Miramar (Town Clerk). Deposit £200. Board of Trade Commercial Intelligence Department, London, E.C.

December 30th.—The Napier B.C. is inviting tenders for two motor-driven centrifugal pumps, of British manufacture only.

Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, E.C.

January 6th, 1913.—Switchboards, for the Auckland Harbour Board. See "Official Notices" November 15th.

Portugal.—By a decree of the Minister of Public Works, a Commission has been appointed for the building of a new head post, telephone and telegraph office in Lisbon. The staff of inspectors for the electrical industry will also be lodged in the same building. Should the scheme be realised, there will be a large demand for electric apparatus. Firms seeking to secure orders should apply to the General Administration of Posts and Telegraphs, Lisbon.—*Electrotechnische Nachrichten.*

Rathmines.—November 25th. Electric wiring of the new Carnegie Library and Technical Institute, for the Rathmines and Rathgar U.D.C. Specification 10s. 6d., can be seen or obtained at the Council's electricity works.

Rimini (Italy).—November 26th. Offers required for the supply to the workshops at Rimini of an electric truck.

Spain.—November 30th. Tenders are being invited by the municipal authorities of Calanas for the establishment of a central electric lighting station in the town.

November 30th.—The municipal authorities of Finisterre (province of Coruna) are inviting tenders for the concession for the electric lighting of the town during a period of four years.

Trimdon Grange (Co. Durham).—December 7th. Electric fittings for a year, for the Trimdon Grange Colliery. The Storekeeper.

Vienna.—December 9th. Tenders are required for the supply and erection of an electrically-worked locomotive turntable in the Mährisch-Ostrau-Oderfurt railway station. Particulars of the K.k. Nordbahndirection, Vienna.

Wigan.—November 25th. Uniform clothing for the Corporation tramway employés. Mr. F. Buckley, tramways traffic manager.

CLOSED.

Atherton (Lancs.).—The U.D.C. has accepted the tender of the British Westinghouse Co., Manchester, for a 250-K.V.A. transformer.

Australia.—The following contracts have been placed, according to the *Australian Mining Standard* :—

MELBOURNE.—P.M.G.'s department :—

Rubber-insulated copper conductors.—Australian Metal Co., Ltd., £3,615.
Copper wire, braided.—B.I. and Helsby Cables, Ltd., £530.
Rubber-insulated copper wire.—W. T. Henley's Telegraph Works Co., £6,263.
Instruments (measuring).—Western Electric Co., Ltd., £127.
10,000 stoneware insulators.—Commonwealth Art Pottery Co., £104.
Material for wireless telegraph stations.—Inglis, Smith & Co., £108.

BRISBANE.—P.M.G.'s department :—

170 miles wire.—Brabant, £585 and £1,445.
374 yd. cable.—B.I. and Helsby Cables, Ltd., £301.
990 yd. cable.—W. T. Henley's Co., £256.
100 iron poles.—Stewarts & Lloyds (Australia), £437.

HOBART.—P.M.G.'s department :—

Common-battery switchboards.—Bartram & Son Pty., Ltd., £318.

SYDNEY.—P.M.G.'s department :—

Switchboard for Peterham Exchange.—Western Electric Co. (Australia), Ltd., £4,646.

ADELAIDE.—P.M.G.'s department :—

Telephone switchboards.—J. Bartram & Son and Western Electric Co.
10 miles wire.—Theodore Zwicker & Co., £203.
10 miles copper wire.—Noyes Bros., £174.
50 miles tinned copper wire.—W. T. Henley's Co., £545.
200 common-battery telephones.—Western Electric Co., £372.

Brighton.—The T.C. Electricity Committee recommends the extension of the agreement with Messrs. Siemens Bros. Dynamo Works, Ltd., for the supply of Wotan lamps for side-street lighting.

Dewsbury.—The Dewsbury and District Infirmary Board has accepted the tender of Messrs. Wadsworth & Co., at £280, for a new electric lift.

Doncaster.—The Electricity and Tramways Committee has accepted the following tenders :—

Albion Motor Co.—Motor chassis, £559. } For motor tower
Rawlinson's Motors.—Tower and lorry body, £96. } wagon.
Hadfield's Steel Foundry Co.—Specials in connection with Bentley tramway extension, £254.

Glasgow.—The T.C. has accepted the following tenders for tramways department requirements :—

Commutators.—British Westinghouse Co., Ltd.
Special work.—Hadfield's Steel Foundry Co., Ltd.
M.F. lamps.—Wm. C. Yuille & Co., Ltd.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

WAR OFFICE.

Electric crane.—J. Carrick & Sons, Ltd.
Telephones.—Spagnoletti, Ltd., West London Scientific Apparatus Co.
Electrical transporter.—John M. Henderson & Co.

INDIA OFFICE, STORE DEPARTMENT.

Cables.—Siemens Bros. & Co., W. T. Henley's Telegraph Works Co.
Generating set.—Lancashire Dynamo & Motor Co.
Insulators.—Marconi's Wireless Telegraph Co.
Mouthpieces, &c.—Peel-Conner Telephone Works, Ltd.

CROWN AGENTS FOR THE COLONIES.

Telephone cable.—British Insulated & Helsby Cables, Ltd., W. T. Henley's Telegraph Works Co.
Submarine cable.—Telegraph Construction & Maintenance Co.
Tubular poles, &c.—Siemens Bros. & Co.
Pole parts.—Francis Morton & Co.

OFFICE OF WORKS.

Lifts and cranes for new Stationery Office for Office of Works stores.—Aldous and Campbell, Ltd,

G.P.O.

Telephonic apparatus.—Automatic Telephone Manufacturing Co., British L.M. Ericsson Manufacturing Co., International Electric Co., London Electric Wire Co. and Smiths, Ltd., Peel-Conner Telephone Works, Ltd., Siemens Bros. & Co., Western Electric Co.
Wood arms.—Millar's Timber & Trading Co.
Electric light cable.—J. Frankenburg & Sons, Ltd.
Telephonic cable.—British Insulated & Helsby Cables, Ltd., Callender's Cable & Construction Co., W. T. Henley's Telegraph Works Co., Johnson & Phillips, Ltd., Siemens Bros. & Co., Western Electric Co.
Stoneware ducts.—Albion Clay Co.
Electric light fittings.—General Electric Co.
Telegraphic ironwork.—Bullers, Ltd.
Telegraphic wire.—India-Rubber, Gutta-Percha & Telegraph Works Co., London Electric Wire Co. and Smiths, Ltd.
Wireless station, Valentia Island, Ireland.—Patrick Murphy.
Equipment of Edinburgh Central Telephone Exchange.—Western Electric Co.

Keighley.—The T.C. has accepted the tender of the Trackless Trolley Co., Ltd., for the overhead equipment for trolley vehicles from Ingrow Bridge to Haworth (1 mile 1,400 yd.), at £1,610, on condition that a car shall be sent on trial for three months, and that if the system is considered to be unsatisfactory, the company will, free of charge, alter the equipment and adapt it to such other method of current collection as the T.C. may require.

London.—L.C.C.—Consequent upon the Council's reference back of the Highways Committee's recommendation to accept a tender by Messrs. J. Batt & Co., for foreign-made driving-wheel tires and pony-wheel tires (as already reported), the Committee now recommends tenders for acceptance as follows :—

Cammell, Laird & Co.—6,000 driving wheel tires, at £1 4s. each.
Henry Bessemer & Co.—5,000 pony wheel tires, at £1 1s. each.

Nuneaton.—The T.C. has accepted the tender of Callender's Cable & Construction Co. for cable for extensions, at £97.

Ramsbottom.—The U.D.C. has accepted the tender of Messrs. Stewarts & Lloyds for poles and fittings required for the overhead equipment in connection with the tramways.

Salford.—Messrs. Quilliam Bros. have received an order from the Corporation tramways for four Collins' patent automatic point turners with patent mercury stuffing box.

Sunderland.—The T.C. last week accepted the following tenders :—

General Electric Co.—27 flame arc lamps.
E. Cleaton, Rees & Co.—Oil.
W. G. Farrow & Co.—Tubing and bends.
India-Rubber & Gutta-Percha Co.—Cable.
British Insulated & Helsby Cables.—E.H.T. cable.
Albion Clay Co.—Two-way conduit.
British Westinghouse Electric & Manufacturing Co.—Wattmeters.

Watford.—The B.G. has accepted the tender of Messrs. Rogers & Gowlett, Ltd., of Watford, for electric wiring, &c., at the workhouse.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 22nd. At Newcastle. Conversazione.

Institution of Electrical Engineers (Newcastle Students' Section).—Monday, November 25th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Heating and Cooling of Electrical Machinery," by Mr. P. Grice.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, November 26th. At 7.30 p.m. At the Municipal School of Technology, Mancheater. Paper on "Individual Electric Driving in a Modern Weaving Shed," by Mr. S. N. C. K. Whitehead.

Faraday Society.—Tuesday, November 26th. At 8 p.m. At the I.E.E., Embankment, W.C. Papers on "The Billiter Alkali-Chlorine Cells," by Mr. A. J. Allmand; and "Note on the Electrolysis of Nitric Acid Solutions of Copper," by Mr. J. H. Stansbie.

Institution of Electrical Engineers (Birmingham Section).—Wednesday, November 27th. At 7.30 p.m. At the University, Birmingham. Paper on "Earthed *v.* Unearthed Neutrals on Three-Phase A.C. Systems," by Mr. J. S. Peck.

Institution of Electrical Engineers (London).—Thursday, November 28th. At 8 p.m. Paper on "Earthed *v.* Unearthed Neutrals on Three-Phase A.C. Systems," by Mr. J. S. Peck.

Association of Engineers-in-Charge.—Saturday, November 30th. Social Dance.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week :—

Monday, November 25th.—"A" Company. Company training, 7 to 10 p.m.

Tuesday, November 26th.—"B" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Thursday, November 28th.—"C" Company. Company training, 7 to 10 p.m.

Friday, November 29th.—"D" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Saturday, November 30th.—"D" Company. Run with portable searchlight set, at 3 p.m., for work on Wimbledon Common. "A" Company.—Run at Fort Coalhouse. Parade at Fenchurch Street Station at 3 p.m. Dress: Service dress, putties and greatcoat.

(Signed) P. H. Campbell, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

NOTES.

The Electrical Engineers' Ball, 1913.—The tenth annual Electrical Engineers' Ball will be held at the Hotel Cecil on Friday, January 31st. The Banqueting Room and the Supper Rooms have been redecorated since last year, and the dancing floor has been relaid. Mr. H. Glenister's Band has again been engaged for the occasion. The following gentlemen have consented to serve on the Committee :—

Alabaster, H.	Geipel, K.	Nalder, F. H.
Anderson, A. Bruce	Geipel, W.	Nash, E. A.
Bailey, F.	Gray, Jas.	O'Meara, Major
Baldwin, O. H.	Gray, R. Kaye	Partridge, G. W.
Belfield, R.	Grote, E. R.	Pearson, Hugh A.
Berry, H. H.	Hadley, A. E.	Railing, M. J.
Blunt, W. W.	Hawes, F. B. O.	Roberts, Martin F.
Bowden, J. H.	Hammond, R.	Rosenthal, J. H.
Brousson, R. P.	Hill, Charles	Rutherford, W.
Browett, T.	Highfield, J. S.	Rowell, P. F.
Brown, C. S. Vesey	Hirst, H.	Sharp, Sydney
Byng, Leonard	Holden, Col. H. Capel	Shepherd, J.
Callender, Jas.	Hooper, John P.	Siemens, Alex.
Cramb, A. C.	Huddleston, J. Snow	Sillar, A. M.
Davenport, F. R.	Kingsbury, J. E.	Scholey, H.
Dobson, Sydney	Leaf, H. M.	Sparks, C. P.
Dunlop, D. N.	Leigh, F. A. C.	Steinitz, J. J.
Elder, T. C.	Madgen, W. L.	Sutton, G.
Ferranti, S. Z. de	Matthews, W. Lee	Taylor, J.
Fox, E. J.	Mordey, W. M.	Wallis-Jones, R. J.
Garcke, E.	McMahon, P. V.	Wordingham, C. H.
Gatehouse, T. E.	Murray, Lee	

Executive Committee.—Baldwin, O. H.; Fox, E. J.; Madgen, W. L.; McMahon, P. V.; Shepherd, J.; Wallis-Jones, R. J; Wordingham, C. H.
Hon. Secretaries.—Alabaster, H.; Sillar, A. M.
Hon. Treasurer.—Kingsbury, J. E.

Inquiries.—A correspondent asks where "Saterite" insulating material can be obtained. Makers of the "Defiance Resistance" and "Marmorite" are asked for.

Manchester Electro-Harmonic Society.—We have received from the musical director a programme of the second concert of this newly-formed Society, to be held on Friday, November 29th. From a musical point of view it is splendid, and brings back to our minds the old days of the London Electro-Harmonic Society, when Haydn, Mozart and Mendelssohn quartets and trios, Bach's double concerto for two violins, Maurer's concertante for four violins, &c., were welcomed and thoroughly enjoyed. Part singing, too, was then made a feature, and what can give greater pleasure to a cultured musician who can follow something more than mere melody, the soul of music though it be, unless it is Chamber music? But, alas! *Tempora mutantur, et nos mutamur in illis.* The taste of late years, amongst the younger people, at all events, is all for the variety and lightness of the halls, a new turn every five or ten minutes, and in a programme of but 11 items, to perform two complete instrumental trios, would be enough to clear the King's Hall, although in the early days members, who are no longer to be seen at these concerts, were keen supporters of the classical side of the Divine Art. We can only express the hope that Mr. Smith will be able to retain the high standard he has set; we must "wait and see." It may be added that the Manchester Society will be specially pleased to welcome any London friends.

"Northampton" Past Day Students' Association.—The winter programme of this Association opened with a very successful whist drive at the Furnival Hall, Holborn, last Friday evening. The N Ions (for such is their name) duly arrived in couples, but electrolysis soon started, and dissociation followed in the usual way. The next meeting is the annual reunion of country members on Saturday evening, December 28th, at the Northampton Institute.

Glasgow Electricians' Strike.—On Saturday at noon 500 electrical workmen in the employment of various Clydeside shipbuilding firms struck work. The present maximum rate is 8½d. per hour, and the men demanded an increase to 9d. Three firms, Messrs. Brown & Co., Clydebank, W. Beardmore & Co., Dalmains, and the Fairfield Co., Govan, all of whom have pressing Admiralty contracts on hand, agreed to concede the advance, but the other firms refused. A strike as stated was declared, and the majority of the electricians have come out; there were no indications of a settlement at the time of going to press.

Rheims Congress of Electroculture.—The first International Congress of Electroculture and applications of electricity to agriculture and agricultural industries, was held at Rheims, from October 24th to 26th, under the presidency of M. Lonay. M. Berthault represented the Minister of Agriculture, and M. Gautier the Academie des Sciences. Delegates from Russia, Hungary, Belgium and Luxemburg were also present.

Several papers were read on electroculture, the first being an historical review by Lieut. Basty, who has tested a number of methods, including those of Paulin and Schtchawinsky, in his gardens at Angers, and who has invented a *petit paratonnerre* and *dynamocapteur*—the first being on the point-collector principle, and the latter employing a zinc-copper couple connected by a wire. According to M. Basty, the growth and maturity of plants are hastened, and a finer crop is secured, by the application of the above methods; germination is accelerated by the passage of a very weak current. On the other hand, M. Kövessi has found the passage of D.C. through soil in which grain is sown, to retard and impair germination—particularly in the neighbourhood of the electrodes. M. Pilsoudsky reported very favourable results from the use of iron-zinc couples on a very large scale in the south of Russia.

M. Blondin described the manufacture of nitrogenous manures from atmospheric nitrogen :—(1) By the formation of cyanamide from calcium carbide; (2) by the formation of an aluminium nitrate which is converted to ammoniate, and then to ammonium sulphate; (3) by the use of a high-tension spark discharge. The latter process is operated on a huge scale in Norwegian works, and M. Blondin communicated numerous details of working.

M. Fillet dealt with electric ploughing as practised in various parts (chiefly colonial). A temporary or trailing supply cable is employed, and the plough is hauled to and fro between trucks (one of which may simply act as an anchor), at opposite sides of the field. Electric motors are now quite suitable for this duty, and require little upkeep. Under certain conditions, it is advantageous to erect private generating stations.

M. Leclerc communicated his experience with electrically-driven root and chaff cutters, &c.—machines which require low power, and work only 200-250 hours per annum. Threshers require up to 10 H.P. It may be assumed that a farm consumes about 10 KW.-hours per acre per annum for lighting and the operation of "indoor" machinery. The advantages in favour of large distribution networks from large central stations were explained.

M. Escard discussed the application of electricity to the sterilising of food stuffs (butter, flour, &c.) and water, and to the bleaching of flour and the dissipation of fogs.—*Génie Civil.*

Fatalities.—Leeds.—Mr. J. C. Malcolm, the Leeds City Coroner, on Monday held an inquest on the body of Edwin Howgate (17), of Maud Street, who was found unconscious in a burning cellar in the Fox and Grapes Yard, Kirkgate, on Friday afternoon. He was taken to the infirmary, and died before admission.

Benjamin Howgate, smallware dealer, Kirkgate, the tenant of the cellar, stated that fumes and smoke were issuing from the cellar when he was called to it. He found no sign of a blaze, however, but he noticed the electric motor buzzing. He inquired for his nephew, the deceased, who understood the working of the motors, but no one knew where he was. Witness went to find him, and on returning met his brother, who told him the lad was in the cellar dead. Two men brought him up in an unconscious condition. Witness also said that the cellar had been flooded a few days ago owing to the stoppage of a sewage pipe. The medical evidence showed that the condition of the body was quite consistent with its having received an electric shock.

Mr. Albert Jones, electrical engineer, said the coils of the motor were completely burnt out, and had no doubt been blazing. As a result of the flooding the coils had been soaked through. They became connected electrically with the motor frame, and immediately the current was put on the motor it would either blow the fuse or burn up the coils. The latter evidently occurred, and the machinery had been made so that anyone touching it would receive a severe shock.

The jury returned a verdict of "Accidental Death."

South Staffs.—The County Coroner held an inquest at Bilston on Monday relative to the death of Frederick Rigby (18), which had occurred at the Spring Vale Works of Alfred Hickman, Ltd. The evidence of an electric crane driver named Frank Schofield went to show that the deceased youth had been working an electric controller for some months past, and he was regarded as a capable operator. On the night of the 15th inst. Schofield went to ask Rigby a question, and found him leaning on the controller. He did not speak, and Witness switched off the current, whereupon Rigby fell to the ground. He was picked up, but death took place within a few minutes. There was a burn on the youth's left forearm, and witness came to the conclusion that he must have sustained it on the guard or on the contact. Replying to Mr. Haslam, who represented the firm, witness said there was a wooden platform from which the controllers should be worked. The iron plate on which Rigby was standing

was on the other side of the controller and Rigby should not have been on it. Dr. John Wells, who had made a post-mortem examination, said he could not attribute death to anything, but having heard the evidence as to the burn on the forearm, he considered the youth was killed by an electric current having passed through him.—William Wetherall, electrical engineer at the works, said the wood platform was the proper place from which to work the controller. The latter was tested immediately after the accident had been reported, and it was found to be all right. The jury found that Rigby was killed by an electric shock, the result of an accident, and suggested that there should be more protection for the men. Mr. Haslam said the firm were willing to carry out any suggestion approved by the factory inspector.

A 2,000-B.H.P. Single-Cylinder Diesel Engine.—From time to time we are permitted to penetrate a little into the semi-secrecy with which Continental Diesel engine builders surround their development of the large Diesel engine. Our contemporary, *The Motor Ship*, in its last issue, published a view of a complete 2,000-B.H.P. single-cylinder Diesel engine in Messrs. Krupp's works, which is the first photograph that we recollect having seen of a complete engine of this type. We gather that as much as 2,500 B.H.P. has been developed in its single cylinder, which is of the two-cycle double-acting type. Views have, of course, appeared of large Diesel engine cylinders, but the cylinder alone does not constitute an engine.

Concert.—The Lamp and Wiring Supplies Department of the British Thomson-Houston Co., Ltd., held a smoking concert at The Cannon, Walbrook, E.C., on Tuesday evening last, Mr. J. N. Stephens presiding.

Appointment Vacant.—Assistant to mains superintendent, for the Greenock Corporation Electricity Department (50s.). See our advertisement pages in this issue.

The Light Railways Bill.—In the House of Commons on 18th inst., this Bill, as amended in Standing Committee, was considered, and Mr. Robertson moved to omit Clause 2 giving power to the Light Railways Commissioners to authorise railless trolley systems. The result would have been, says the report in the *Times*, to leave matters connected with railless trolley systems in exactly the position which they had previously occupied. "It seemed desirable that questions of responsibility for road maintenance should be dealt with in a general and systematic manner." The voting for the clause was 134, and against 315—majority against 181. An amendment to Clause 6, moved by Mr. Robertson, was described by him as "practically a drafting amendment, designed to meet the fear expressed in Committee, that the local authorities would be under no check," and it was carried by a majority of 177.

Prize Distribution.—The distribution of prizes and certificates at the Borough Polytechnic Institute takes place on Monday, December 2nd, at 8 o'clock p.m. Sir Albert Spicer, M.P., will make the presentations.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At the opening meeting of the session on Thursday last week, Dr. Ferranti presented the premiums awarded for papers read during the past session, and announced that Prof. S. P. Thompson had presented a medallion of William Gilbert to the Institution. He then read the list of names of the members of the Industrial Committee, which are as follows:—Mr. Duddell, F.R.S. (President I.E.E.); Mr. H. Hirst (Chairman of the Committee); Messrs. A. B. Anderson, G. Balfour, G. H. Bowden, D. N. Dunlop, S. Z. de Ferranti, E. Garcke, F. Gill, Godfrey Isaacs, H. C. Levis, C. H Merz, R. K. Morcom, W. M. Morrison, S. Morse, A. H. Preece, H. Faraday Proctor, W. Rutherford, A. H. Seabrook, A. Siemens, Dane Sinclair, C. P. Sparks, A. H. Stanley, A. de Turckheim, F. J. Walker, and H. E. Wimperis.

Dr. Ferranti then vacated the chair, and Mr. Duddell, the new president, read his inaugural address. In moving a vote of thanks, Mr. W. M. Mordey spoke of the excellent work that had been accomplished by the president, not only in electrotechnics but also in the service of the Institution, and Sir John Gavey, who seconded the motion, described how Mr. Duddell, on receiving from him the suggestion that some means of measuring the excessively weak currents received in wireless telegraphy was urgently necessary, in the course of a few weeks succeeded in devising a satisfactory instrument, and thus overcame one of their greatest difficulties.

Physical Society.—At the meeting held on November 8th, a paper "On a Method of Measuring the Thomson Effect" was read by Mr. H. R. Nettleton. In this paper an investigation is made of the distribution of temperature along a conductor conveying an electric current and at the same time moving uniformly through two fixed temperature sources. The effect of the Thomson heat on the distribution is seen to be exactly similar to the effect of a small impressed velocity. This result is applied to mercury to measure the Thomson effect.

A paper on "An Improved Joule Radiometer and its Applications" was read by Mr. F. W. Jordan. An abstract of this was given in our last issue.

A paper on the "Thermomagnetic Study of Steel" was read by Dr. S. W. J. Smith. Thermomagnetic measurements make it increasingly evident that the magnetic properties of steels are frequently those of mixtures of magnetic substances, each possessing characteristic properties, which contribute in a comparatively definite way to the properties of the material as a whole. In the case of a simple ferromagnetic substance, magnetising fields can generally be found in which the permeability variation with temperature is comparatively small except in the neighbourhood of the critical temperature. In such fields there is a very clearly marked peak in the permeability temperature curve for the substance. The explanation of this peak which the molecular theory affords is well known, and suggests that the phenomenon should be found common to all ferromagnetic substances. The immediate object of the paper is to show that it is exhibited by the carbide of iron (cementite) which exists in annealed carbon steels.

Illuminating Engineering Society.—At the meeting on Tuesday last, the hon. secretary, Mr. Leon Gaster, reported on progress made during the past few months. Reference was made to the importance now attached by the Home Office to the subject of the lighting of factories, to the work done at the International Congress held in Milan last May in connection with the prevention of industrial accidents, and to the lighting of mines and miners' safety lamps. Papers were also read on "Ancient Forms of Lamps" (Mr. J. W. Johnston), "A New Illumination Photometer" (Mr. Haydn T. Harrison), "Some Simple Colour Boxes" (Mr. W. C. Clinton), "Photography in Illuminating Engineering" (Messrs. J. S. Dow and V. H. Mackinney), and "Miners' Lamps."

Royal Scottish Society of Arts.—"Electric Projectors and Some of their Uses" was the subject of a paper read by the vice-president, Mr. Alex. Ogilvie, B.Sc., at the annual general meeting. Mr. Basil A. Pilkington, for his paper on "Some Recent Improvements in Electric Single Wiring, with Special Reference to the Author's Terroid System," was awarded a Makdougall-Brisbane prize, value £5.

Institution of Electrical Engineers (Manchester Section).—A meeting of the Section was held on Tuesday, when Mr. J. S. Peck read a paper on "Earthed *v.* Unearthed Neutrals on A.C. Systems." A discussion followed, and was replied to by the author.

Institution of Electrical Engineers (Scottish Section).—On the 12th inst. the opening meeting of the session was held, and the chairman, Mr. W. McWhirter, gave his inaugural address.

Liverpool University Engineering Society.—On Tuesday last week Mr J. S. Peck, consulting electrical engineer to the Westinghouse Co., Ltd., of Manchester, read a paper on the design of high-voltage long-distance transmission plant.

Junior Institution of Engineers.—At a recent meeting a paper was read by Mr. A. H. Tyler on "The Application of CO_2 to Refrigeration." It was pointed out that CO_2 had much to recommend it as a refrigerating medium, as it was inexpensive, generally obtainable and safe to handle, being inodorous and harmless.

Electrical Association of New South Wales.—According to the *Australian Mining Standard*, the annual meeting of the Association was held at Sydney last month. At the conclusion of the ordinary business a paper was read by Mr. Burgess (newly-elected president) on "Some Notes on Electric Heating and Cooking."

Association of Mining Electrical Engineers.—A meeting of the West of Scotland Branch was held on Saturday last at Glasgow, when an interesting paper was read by Mr. A. Campbell King, colliery manager, Wallhouse, Linlithgowshire, on "The Electrification of a Small Group of Collieries." The author held that if current had to be distributed over fairly long distances, it ought to be at a pressure of 3,000 volts or thereabouts, alternating two or three-phase, and he would use this in the mine at a voltage of 450 or 500, either alternating or direct current. It was to be regretted that a fair proportion of electrical accidents happened with coal-cutters. He thought that compressed air was the ideal motive power for coal-cutting machines; but in order to obviate the loss in transmission of power, he would use a motor-driven compressor situated at a convenient distance from the face and thence lead air pipes to the gate ends. This system would allow coal-cutting to be carried on under conditions where electrical coal-cutters could not safely be operated owing to gas. A coal-cutter was not an ideal subject for electrification, because the conditions under which the motor had to work were anything but satisfactory, owing to vibration and dust. Next to compressed air, however, he held that the D.C. was better than the A.C. machine. In the earlier days of the electrification of collieries he had seen very shoddy electrical plant and fittings supplied. An attendant would keep a motor or generator in better condition if it came to a colliery decently finished and substantially made.

Discussion was thereafter resumed on the paper read by Mr. A. B. Muirhead, Lenzie, at the last meeting, on "Notes on Electricity, Rule No. 7." It was announced that a smoking concert under the auspices of the branch would be held in Glasgow on Saturday, December 14th.

Institution of Electrical Engineers (Western Section).—The inaugural meeting of the Western Section was held at the Engineers' Institute, Cardiff, on Monday, when Mr. W. A. Chamen delivered his inaugural address, of which we give an abstract on another page.

A dinner subsequently took place at the Park Hotel, and was well attended, the chairman being supported by the Lord Mayor of Cardiff, Mr. A. P. Trotter, of the Board of Trade, Mr. W. N. Lewis, chairman of the Cardiff Chamber of Commerce, Mr. W. Judd, Mr. W. McWhirter, chairman of the Scottish Section, Mr. Faraday Proctor, Mr. Arthur Ellis, and many other well-known gentlemen.

The loyal toasts having been duly honoured, Mr. W. D. Wight, in a happy speech, proposed "The Institution of Electrical Engineers and the Western Section." Mr. W. Judd responding, congratulated the Western Section upon its inauguration. He said it was thought in London that the Institution was in a flourishing condition. The hard work of the past few years was now likely to bear fruit. The result of a great deal of consideration was to give the Institution a handsome and commodious

habitation, with the object that it should not only add to the dignity of the Institution, but should also be a centre for electrical work. Steps would be taken very soon to form a lending library in connection with the Institution, so that members from the provinces might see valuable works of reference. It would, he believed, be without doubt the finest electrical library in the world, and would be a very valuable asset. All the misunderstandings between the central body and the local sections were now cleared away, and a feeling of friendship and solidarity had been established. The new president was imbued with progressive views, and there were other schemes before the Council, and a good deal of work was being done.

Mr. W. A. Chamen, who also responded, said it was the desire of the Council to make the Institution really a useful power throughout the land. There was a fear, a little time back, that small societies would be formed in the provinces, and particularly in South Wales, and the only result of that would be the formation of another unit, which would take away some of the power and force which might be available to the great parent Institution for carrying through its measures, and there was undoubtedly a very effective power behind a large body of people who were united. London understood the feeling in the provinces to the full, and wished to encourage them in every possible way; and down in Wales they desired the assistance of all electrical engineers who had not yet become members. There was between 260,000 and 300,000 H.P. of motors working in the Western district, but in spite of that only about 213 members of all grades had joined, and a very small amount of reflection would show that there was something wrong in that, for there must be a great number of people who were eligible, and who ought to join. Arrangements had been made for holding meetings if necessary in the remote corners of South Wales, as well as at Cardiff and Bristol, in order to get the electrical profession generally interested in the work of the Institution.

Mr. W. McWhirter then proposed the toast of "The City of Cardiff," to which the Lord Mayor suitably responded.

Mr. W. North Lewis, in proposing the health of the Chairman, said that South Wales and the West of England were looking forward to great electrical developments in the near future.

Mr. Chamen briefly returned thanks.

During the evening a capital musical programme was gone through, the artistes being Miss Mabel Mander, Mr. Granville Tate and Mr. Sam Taylor. Madame Mander Fox, R.A.M., was the accompanist.

Institution of Electrical Engineers (Yorkshire Local Section).—The second general meeting of the session will be held at the Leeds University, on Wednesday, December 4th, at 7.15 p.m., when a lecture will be delivered by Prof. J. Goodman on "Roller and Ball Bearings." A plain tea will be provided at the University, between the hours of 6 p.m. and 7.15 p.m., at the rate of 6d. per head, for the convenience of members who desire to fraternise.

Lecture.—Mr. O. Cooke, of West Moors, on Monday last week, entertained a large audience, assembled under the auspices of the Wesley Guild, Wimborne, with a lecture on electricity.

Holborn Public Lighting.—Referring to the article in connection with the Holborn public lighting, which appeared in our issue of the 15th inst., Mr. J. S. Highfield writes to point out that the reflectors used in the lanterns were not of his design, as there stated. The lanterns were designed by him, but the form of reflector employed is that designed by Mr. Haydn Harrison, and used by him in several of his lanterns, and Mr. Highfield wishes to take the earliest opportunity of pointing out that to Mr. Haydn Harrison is due this ingenious form of reflector.

The Cliff Lift at Scarborough.—At the annual meeting of the Scarborough Central Tramways Co. on Wednesday—the company controls a lift from the top of the cliff to the bottom—the chairman remarked that the cost of electric power had been very satisfactory. The power was converted from steam to electricity about two years ago. The chairman added that they used to pay for coke, when running the old engines, as much as £44, but last year the cost was only £20 for electricity and coke. The number of passengers booked for entertainment places was 40,678, against 23,546 the preceding year. The total number of passengers carried was 204,082, and the number of trips 32,211. The chairman added that theirs used to be a 6 per cent. dividend-paying concern, but the street tramways had hit them hard. They were now again on the up-grade, and the dividend had risen from 2s. to, this year, 3s. 6d. per share (£5).

Staff Dance.—In connection with the Newcastle-upon-Tyne Electric Supply Co., Ltd., a Staff Dance was held at the Heaton Assembly Rooms Heaton Road, on Friday evening, November 15th. Mr. and Mrs. R. P. Sloan received the guests at 7.45 p.m., and dancing continued from 8.15 p.m. to 1 a.m. There was a total attendance of about 240, which included a large number of staff members from the various departments, and also several former members of the company's staff. The organisation was in the hands of a representative committee. The rooms were tastefully decorated; music was by Mr. R. Jackson and orchestra, and the catering by Mr. T. Hall. Special travelling accommodation was provided at the termination of the dance, to convey people to the coast, Benton and the neighbouring districts.

Pulling the Trolley Cord.—Albert Ashwin was summoned at West Ham for interfering with the trolley cord of a tramcar. He is reported as saying that he unwittingly "touched the wrong string." He was fined £2 and £1 1s. costs.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. L. H. Cumberland, assistant charge engineer at Hampstead, has resigned, in order to take up an appointment as charge engineer at Dewsbury Corporation Electricity Works.

The Watford U.D.C. has appointed Mr. T. Hollins junior shift engineer, as assistant mains superintendent, vice Mr. R. S. Savory resigned.

Mr. A. Mercer, outside superintendent at the Gravesend Corporation Electricity Works, has resigned.

At Nelson Town Council, last week, the resignation of Mr. Rennie H. West, the chief clerk in the electricity department (who is leaving for Manchester), was accepted; Mr. Ralph Wilmore was promoted to the position of chief clerk.

The Tunbridge Wells T.C. has granted an additional remuneration of £30 to Mr. J. Bemrose, chief assistant electrical engineer, in respect of the satisfactory services rendered by him whilst in charge of the undertaking from August 20th to October 14th.

Mr. C. H. Tritton, of Gillingham, has been appointed to the post of shift engineer at Watford electricity works.

Tramway Officials.—Mr. W. Binns, engineer and manager of the Corporation tramways at Reading, has accepted an important appointment at Para, Brazil. Mr. Binns went to Reading from Newcastle-on-Tyne in 1903. The T.C. on November 14th decided to grant 100 guineas to Mr. Binns as remuneration for extra and special services rendered in connection with the tramway undertaking.

Consequent upon the resignation of Mr. Binns, the T.C. has appointed Mr. G. F. Craven, chief assistant engineer, as general manager and engineer of the tramways, at a salary of £400 a year; Mr. Jas. McLennan Calder, tramways works assistant, as chief assistant engineer, at £180 a year, rising by £10 per annum to £200; and Mr. Francis Harry Glover, engineering assistant at the depôt, as works assistant at £150 a year, rising by £10 per annum to £180.

After holding the position of engineer and manager at the Devonport and District Tramways for about four years, Mr. C. W. Durnford has left that borough to take up the appointment of manager of Sheerness and District Electric Light, Power and Traction Co., and has been succeeded at Devonport by Mr. George Cardwell, formerly general manager of the Hartlepool Electric Tramways Co. Before leaving for Sheerness, Mr. Durnford received a parting gift from the employés in the shape of a rose bowl.

General.—Following upon the recent municipal elections in Glasgow, changes have taken place in the converships of the Tramways and Electricity Committees. The new conveners and sub-conveners are:—Tramways: Bailie Robt. Kirkland, convener; Bailie James Alston, sub-convener. Electricity: Bailie Wm. B. Smith, convener; Councillor W. H. Hanway, sub-convener.

The directors of the Chelsea Electricity Supply Co., Ltd., have appointed Mr. W. R. Davies to be chairman of the company, and Mr. Stanley Beeton to fill the vacancy on the board caused by the death of Sir Irving Courtenay.

At the fortnightly meeting of the Nenagh Urban Council, last week, Mr. Louis Lawless was appointed electrical engineer for the purpose of supervising the erection of an electric plant for Nenagh. There were three applicants for the position.

Mr. Howard, borough electrical engineer at Taunton, has been appointed Lecturer in Electrical Engineering at the Borough Technical Institute.

After 42 years' service in the Postal Telegraph Department of the Post Office, Mr. H. R. Kempe, the Electrician to the Department, retires at the termination of the present year.

The Council of the Chartered Institute of Secretaries has elected Mr. F. J. Walker (St. James' and Pall Mall Electric Light Co., Ltd.), treasurer; and Mr. A. F. Harrison (City of London Electric Lighting Co., Ltd.), a member of the Council.

Mr. Harold D. Symons has resigned his position with the British Westinghouse and Manufacturing Co., Ltd., in order to take up the management of the European business of the Sterling Varnish Co. Mr. Symons's appointment dates from the 1st inst.

Mr. Councillor F. Denning, J.P., and Mr. Councillor J. O. Pelton, J.P., have been elected chairman and vice-chairman respectively of the Croydon Corporation Tramways Committee.

We are informed that Mr. James Walker is about to join the staff of Messrs. Böving & Co., Ltd., water power engineers, and will also join the board of directors. After a lengthy experience with the contracting firm of Messrs. S. Pearson and Son, of Westminster, he was engaged by Messrs. J. G. White and Co., Ltd., with whom he has been for the last nine years, acting as construction superintendent on large works abroad, and latterly as engineer-in-charge of construction in the head office in London. With his wide experience in hydro-electric undertakings and civil engineering work in general, he will be a great acquisition to the firm. Mr. Reginald K. Morcom has also consented to act on the board of Messrs. Böving & Co.

Mr. Alfred H. Gibbings, of Buenos Ayres, is now in this country on a short business visit.

Councillor James Heald has been re-elected chairman of the Lancaster Electricity Committee of the T.C.

CITY NOTES.

Allgemeine Elektrizitäts Gesellschaft.

THE report of the directors for the year ended with June 30th, 1912, recommends, as was mentioned in this journal on November 1st, the payment of a dividend of 14 per cent., being the same rate as in the preceding year. During the year the turnover and orders on hand largely exceeded expectations, and the extension of the company's organisation to almost all parts of the world suggested that a year of general industrial development both at home and abroad would afford increased possibilities of work. In addition, the supply of current from large central stations to large districts was rapidly progressing and placed exceptional demands on the capacity of the workshops. In order to meet these requirements, considerable extensions of the works became necessary, and these had been partly carried out and were partly proposed. Large funds were needed for the acquisition of sites and the erection of buildings thereon, the extension and perfection of works equipment, the financial participation in undertakings in accordance with the economic problems, and the share taken in the capital increase of the Zurich Bank for Electrical Enterprises. It was proposed to widen the financial basis of the undertaking in order to maintain the "liquidity" desirable for the working programme. According to the announcement made in the report for the previous year, 4½ per cent. bonds for £1,500,000 had been issued and the incidental costs of £53,000 had already been written off in the accounts for 1911-12. It was now intended to make an emission of new shares to the nominal amount of £1,250,000, the major portion of which would be offered to existing shareholders by the company's banking group in the proportion of one new share for seven present shares. The accounts show the following figures, those for 1910-11 being added for the purpose of comparison:—

	1911-12.	1910-11.
Ordinary share capital	£6,500,000	£6,500,000
Loan capital	3,987,000	2,517,000
Gross profits	1,405,000	1,257,000
General expenses	43,000	38,000
Taxes	85,000	101,000
Depreciation	35,000	32,000
Net profits...	1,187,000	1,085,000
Reserve fund	150,000	118,000
Bonuses	45,000	42,500
Pension fund	45,000	42,500
Dividend	910,000	805,000
„ per cent.	14	14
Carried forward	36,000	32,000

It should be explained that the rate of 14 per cent. applies to the whole of the ordinary share capital, whereas in 1910-11 new capital of £1,500,000 only participated to the extent of 7 per cent. The gross profits are stated to have been solely derived from manufacturing, whilst those realised from financial transactions are, as usual, not disclosed. As new machinery, tools and patterns have been completely written off as in former years, it is naturally assumed that a portion of the financial profits has been devoted to this purpose, and to any further depreciation that may be necessary other than the sum of £35,000 set forth in the table; and the remainder of the profits from this source has been allocated to the undisclosed reserve fund. It is noteworthy in this connection that apart from the comparatively small holding of Government and municipal loans, a yield of 10·8 per cent. was obtained on the book value of the securities in portfolio. The open or disclosed reserve fund, with the present addition of £150,000, becomes increased to £3,250,000, or one-half of the ordinary share capital.

The report proceeds to state that the deliveries effected by the machinery works, comprised 118,205 machines, and transformers of a total of 2,529,000 H.P., as compared with 92,186 of 2,385,869 H.P. in 1910-11. These figures do not include the turnover at the company's work in Vienna, Riga and Milan, which raises the grand total to 133,499 machines and transformers of 3,620,000 H.P., as against 92,470 of 2,830,000 H.P. in 1910-11. A new development at the Berlin works related to the electrical equipment of submarine boats with a special type of motor and switching apparatus. The prices realised by the turbine works showed a slight improvement, and the steam turbines delivered numbered 312 of 735,648 H.P., as contrasted with 284 of 441,467 H.P. in the previous year. A new speciality was the introduction of boiler feed pumps driven by turbines, and a large number was already in operation. The degree of activity in the arc lamp factory was about the same as in 1910-11, whilst a further favourable development took place in the meter department, notwithstanding declining prices.

The Oberspree cable works were so well occupied that by the adoption of double and triple shifts it was possible to execute the increased orders. The company's consumption of copper advanced from 27,034 tons in 1910-11 to 31,326 tons last year. Concerning metal-filament lamps, the report mentions that the turnover expanded by 80 per cent., and the production had to be permanently extended. On the other hand, the sale of carbon lamps declined under the operation of these circumstances. The comprehensive extensions made by iron and steel producers afforded abundant employment to the company's department for large machines, and the demand for these units continues at the present time. The rolling mill motors delivered and under construction comprised 385 of a total of 680,000 H.P., whilst an increased business was transacted in mining plant. After referring to central stations and tramway work, the report states that two turbo-dynamos, each of 10,000 KW., are about to be started by the Victoria Falls and Transvaal Power Co. and two further units of 12,000 KW. are expected to be brought into operation by the end of this year. The total capacity of the plant supplied by the company to the Victoria Falls Co. will then have reached 230,000 H.P. It is added that the total number of employés is 70,162, as compared with 60,818 a year ago, and 6,551 and 5,454 in the two years respectively are engaged at the works in Vienna, Riga and Milan.

Provincial Tramways Co., Ltd.

MR. ANDREW BEATTIE presided on Friday last over the ordinary general meeting of this company held at the offices, Moorgate Station Chambers, E.C. In moving the adoption of the report (see ELECTRICAL REVIEW, page 800) he said that at the last annual meeting he had the pleasure of presenting an excellent report which was attributed to the very fine summer. The net receipts on that occasion amounted to £36,434, as compared with £33,454 in 1910, an increase of £3,000. It was then stated that the directors were afraid that it would be difficult to keep up to that high water mark. However, the net profits for the year under review were £30,061, which was only a small decrease of £393. That was more than accounted for by the increases in the price of coal, wages, and the company's contribution under the National Insurance Act. Their increased expenditure was considerably more than the decrease in the net profits. It would, therefore, be seen that this year was even better than last year, which was the second best in the history of the company. The directors further desired to point out that the summer of 1911 was a most exceptional one, whereas this year was positively wet, and altogether most unfavourable for tramway traffic. He need scarcely point out that such adverse conditions affected tramway enterprises at seaside towns more than those at inland centres. He asked the shareholders to congratulate themselves on the year's earnings. The directors were more than pleased at the satisfactory results. It showed that a progressive tramways company was directed by men of experience. The dividend of 7½ per cent. was the same as last year. During the past year the directors had given special attention to the question of motor-omnibuses. There were several points in favour of omnibuses as compared with tramways. The cost of running was cheap; there was no track to lay down, and, consequently, a saving in capital expenditure; no wayleaves to pay to local authorities; no payment demanded by local authorities in regard to widenings or improvements of streets; no local authorities calling attention to the state of the track or roadway, and the 'buses could take up passengers close to the footway. It would be seen that the advantages were great, and it would be found the disadvantages were few now that the motor-'buses had reached a point near perfection. In view of these facts, the directors had instituted a service of omnibuses, and with advantage to the company. They did not fear competition from the outside. They were quite alive to all that was going on, and they proposed increasing the number of motor-omnibuses. The fact of having these motor-'bus services would enable the company at any time, if they thought local authorities were unreasonable in their demands for wayleaves or taxation, to be more independent than hitherto. The best relations existed between the company and the different local authorities. They carried out their agreements in the spirit and the letter, and they believed their policy was recognised and reciprocated. The directors had also had under consideration the question of taking upon themselves third-party risks. The premium paid to the insurance company was a little over £1,000, and the actual amount they had been called upon to pay for accidents was £280. That had been about the average for the past four years. It would, therefore, be seen that had the company taken the risks themselves there would have been a considerable saving. It had been thought that if the company could form a reserve of £6,000 at the rate of £1,000 a year they might take the third-party risks. The directors took different views upon the subject. It had to be remembered that should there be a serious accident it would mean a big draw on the company's resources. In the event of no such accident the shareholders would, of course, realise the benefit of saving the premiums which would otherwise go to the insurance company. At present matters were in *status quo*. Turning to the balance-sheet, the chairman pointed out that it did not disclose any details; such information, however, could be obtained by any shareholder. It was to the dividends that the shareholders really looked, and he hoped that the present state of things would continue. He had no reason to suppose that there would be any change. The company was never in a more healthy condition, and he was not without hope that it might be more prosperous than in the past.

MR. S. HERN seconded the motion, and remarked that they felt it was in the interests of the shareholders that they should take steps to take advantage of the motor-omnibus traffic. The directors felt they must not be behind the times.

The report was adopted.

The following resolution was also carried: "That the company be authorised to run motor-omnibuses or cars, motor char-a-bancs, or other mechanically-propelled vehicles either in connection with the tramways or otherwise."

Richard Hornsby & Sons, Ltd.—The directors announce a dividend on the ordinary and new shares of 6¼ per cent., less income-tax, for the year ended September 30th, placing £10,000 to reserve account, and carrying forward £3,877.

Amazon Telegraph Co., Ltd.

MR. GEO. KEITH (chairman) presided on Monday at the offices, 12, Old Broad Street, E.C., over the eighteenth ordinary general meeting of the above company.

In moving the adoption of the report (see ELEC. REV., page 756), the CHAIRMAN said their business in the Amazon had been quiet, and not so active as it was during the previous year, when owing to the exceptionally high price of rubber, and the political troubles in Manaos, there was remarkable increase in the traffic passing over the cables. The rubber statistics showed that the crop last year was the largest ever gathered, but prices were low and steady, which caused a decrease in the number of telegrams required for market quotations. Fluctuations of exchange also always brought in a large number of telegrams, but that also was reduced by the steadiness of the exchange during the year. All this had had a corresponding effect on the year's business. The traffic receipts showed a decrease of about 15 per cent. as compared with those of the preceding year, but were 25 per cent. more than the year before that. Interest on the year's cash balances also brought in £669 more, and the total revenue, including the subsidy, came out at £104,444, or £14,080 less than last year. The expenses at stations showed an increase of £1,290, mainly due to the placing underground of the landlines at Para and Manaos. Establishment expenses had been increased by the additional expense of the new steamer *Ramos*, which went out to the Amazon last June. Surveys and trench cable for the renewal and extension of the Lago Grande cable between Santarem and Parintins had also increased the miscellaneous expenses. On the other hand, the cost of cable used during the year showed a large decrease, and the total expenses attending maintenance and cable showed a decrease of £1,353. The aggregate of the other items of expenditure also showed a decrease, whilst the usual depreciation hitherto written off the *Viking* was omitted and included in the special reserve now established for the renewal and maintenance of cable steamers. Altogether the working expenses amounted to £51,199, or £3,746 less than last year. As regarded the other charges against the year's revenue £15,000 had been paid in debenture interest, but no charge had yet been made for the half-yearly redemption, which commenced this year, and would form a charge on the revenue of the current year. £15,000 was added to the general reserve fund for the maintenance of the cables, and £12,000 was applied to the special reserve for the maintenance of the cable-ships. After meeting these charges and the working expenses the directors were able to recommend the payment of a dividend of 4½ per cent. for the year, leaving £5,664 to be carried forward. Their cables were working well and gave the Government and the public a rapid service. They were still difficult and costly to maintain in the main river of the Amazon, especially when the river was full, but even in that respect the position was gradually being improved. Every opportunity was taken to remove the cable to any side water which could be found suitable for the purpose. Their new small steamer *Ramos* greatly facilitated this work, and removed the delays and difficulties which had hitherto been experienced in effecting shallow water repairs. The *Ramos* was also capable of taking the place of the larger steamer *Viking* if repairs in the main river had to be attended to when that steamer was not available for the work. All this should ensure, as far as possible, the efficient maintenance of the cables, and the perfect working of the business. This year business in the Amazon continued good, and the traffic receipts up to date compared favourably with those of last year. On the 1st inst. their local rates were considerably reduced, but they hoped to recoup this by a satisfactory increase from that traffic during the coming rubber season. He might also mention that the automatic reduction now made in the rates reduced some of the lower ones more than should be, and he hoped the Government would grant a reconsideration of this and of other unnecessary restrictions which acted unfairly on the successful working of the service.

MR. E. B. ELLICE CLARK seconded the motion, and the report was adopted without discussion.

United River Plate Telephone Co., Ltd.

SIR FREDERICK GREEN, J.P., presided on Tuesday over an extraordinary general meeting of the shareholders of this company, held at Winchester House, E.C. In proposing a resolution increasing the number of the directors to six, and the appointment of Mr. George Franklin to a seat on the board, the chairman said the vacancy had been brought about by the lamented death of the late chairman, Sir Irving Courtenay. Sir Irving was one of the original directors when it was a small affair and not very prosperous. For 21 years he had been chairman, and during his tenure of office the company had gone on by leaps and bounds, and he had not the slightest hesitation in saying that it was largely owing to the late chairman's ability and zeal that the company had been brought to its present flourishing position. That had been recognised on the other side of the world as well, for they had received a letter from Dr. Drago, the chairman of the Local Committee in Buenos Ayres, stating how greatly they appreciated Sir Irving's visits to them. He never spared himself in his work for the company, and he absolutely refused to obey the doctor's orders and take things more quietly. All his colleagues on the board greatly regretted his death, and how great his loss was, was quickly found out when they tried to fill his place. He (the chairman) had no doubt that on the board they had sufficient ability to fill the position of chairman, but for one reason or another they had not found it possible among themselves to elect a gentleman who would, in their opinion, satisfactorily fulfil the requirements and do the work which Sir Irving Courtenay had been doing so successfully for the last 21 years. They, therefore, had to look abroad, and he thought they were to be congratulated that they had found Mr. George Franklin, a gentleman whose name stood in the front rank in the telephonic world, able and willing to come on the board. As they knew, Mr. Franklin was the chairman of the National Telephone Co., which had lately been bought by the Post Office, and it was under those circumstances that Mr. Franklin was free to come to them with the view of acting as chairman. He could assure the shareholders that there was plenty of work to do, and although he had no figures, he could tell them that good progress was being made, and they wanted a man of the energy and ability of Mr. Franklin to carry on the work. They found that the authorities in the River Plate were getting more and more exacting, but notwithstanding that, when they met next year he believed they would find the figures satisfactory. There was one pleasing incident connected with Mr. Franklin's proposed election, and that was that their colleague Sir John Gavey, who was an old friend of Mr. Franklin's, and who had been employed by the Post Office to fight their battles against the National Telephone Co., had been very much struck by the ability with which Mr. Franklin was fighting the case for the company. They were the two champions, one on either side, and the fight had been so protracted and so keen that they had both learned to appreciate one another. The reason they proposed to increase the number of directors was that they felt that whenever a casual vacancy occurred on the board they ought to take the opportunity of appointing Mr. David Smith, their secretary, to the vacancy. During the last few months the late chairman had been visibly ailing, and Mr. Smith had been the life and soul of the London office. They thought it was right that they should show some appreciation of his hard work, and they had therefore elected Mr. Smith as a director. By doing that they lost the opportunity of appointing Mr. Franklin to this casual vacancy, but they did it deliberately, because they wished to increase the number of directors beyond what they had been working with lately, and to do that it was necessary to get the permission of the shareholders.

SIR JOHN GAVEY seconded the resolution, and it was carried unanimously.

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

Wednesday, November 27th.—Sun Power Co. (Eastern Hemisphere), Ltd.—150,000 vendors' ordinary shares of £1 each fully paid, Nos. 8 to 150,007.

Thursday, December 5th.—Anglo-Argentine Tramways Co., Ltd.—Scrip fully and partly paid for a further issue of £1,500,000 5 per cent. debenture stock.

And ordered the undermentioned to be quoted in the Official List:—

Anglo-Argentine Tramways Co., Ltd.—Scrip partly paid for a further issue of £1,500,000 5 per cent. debenture stock.

Newcastle and District Electric Lighting Co., Ltd.—£146,040 6 per cent. second mortgage debentures, Nos. 1 to 620A, 622 to 778A, and 780 to 1,429A of £100, and 1 to 167B of £20 each (registered).

Uxbridge and District Electric Supply Co., Ltd.—£75,000 5 per cent. debenture stock.

Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Canadian Western Natural Gas, Light, Heat and Power Co., Ltd.—Further issue of £113,013 5 per cent. first mortgage debenture stock.

Portland Railway, Light and Power Co.—$16,000,000 5 per cent. first and refunding mortgage 30-year sinking fund gold bonds (series "A"), Nos. M 1 to 15,400 of $1,000, D 1 to 800 of $500, and A to J 1 to 200 of $100 each.

Sao Paulo Tramway, Light and Power Co., Ltd.—Further issue of £221,917 5 per cent. perpetual consolidated debenture stock.

STOCKS AND SHARES.

Tuesday Evening.

MARKETS round the Stock Exchange are in a more cheerful frame of mind. Their nerves are becoming case-hardened to scares and alarms. For example: last Monday afternoon a report that Bulgaria and Servia were assuming a belligerent attitude towards Austria failed to exercise anything but the most transitory influence over markets. The Home Railway department, in particular, has been strong, the buying being based upon hopes of benefits to accrue to the railways upon the passing of the Single Clause Bill by the Government, allowing the companies to raise their charges.

By the way, Mr. Keir Hardie's protest against this action is surely one of the quaintest that could be imagined. He maintained that revision of the rates was unnecessary, in view of the fact that "Home Railway stocks had already increased in value since the labour disputes." The views of proprietors of these securities upon Mr. Keir Hardie's suggestion have been a good deal more forcible than printable—at all events, so far as the Stock Exchange is concerned.

Speculation in Central London stocks remains one of the features of the Home Railway market. The Ordinary and Preferred are now on the same lines of quotation, and the Deferred stock shows a rise of 3, so that the improvements during the past fortnight are 12, 2, and 11 respectively. At the last rate of dividend on the Deferred stock, the yield at the present price looks a little odd, and one dealer in the market humorously complained that the return on the money was very little more than that afforded by East London Ordinary or Little Chathams.

City and South London Ordinary has been moving sharply, but after a good rise during the week the price remains unchanged on balance. All four of the company's 5 per cent. Preference stocks are now quoted 107—109. Great Northern and City Preferred

rose ¼ in sympathy with the sharp improvement in Metropolitan Consolidated stock. The latter advanced at one time to 56¼, but from this there was a reaction of nearly 2 points, leaving them only a little better on the week. Districts show a good gain, although the price is well below the best point reached. The Prior Lien stock has moved up to par as its top figure. A good feature has been a jump of 12s. 6d. in Underground Electric Railways Ordinary shares, the buying of which has been very persistent, and, in conjunction, the shilling shares rose to 14s. The 6 per cent. Income bonds, too, are better. We add to our list of prices the company's 6 per cent. First Cumulative Income Debenture stock, which now stands at 113 middle.

In the Traction list, the feature is a further rise of 12s. 6d. in London United Preference shares, while the Company's 4 per cent. Debenture stock is a point higher, these movements being due to the reasons already detailed here. Metropolitan Electric Tramways Ordinary have been a strong market, while the Deferred remain about 6s. The Preference crept up to 18s. 9d., and in the circumstances it is rather surprising that the 4½ per cent. Debenture stock should be slightly easier.

As regards English Electricity Supply shares, rumour runs riot as to what is going to happen to the principal undertakings comprised in this section. Almost every day there comes an addition to the set of reports already current, some of which are obviously very exaggerated; they have the effect, however, of keeping the market strong. The fall in County Preference last week has been wiped out, and the company's Ordinary shares rose ⅛. Kensingtons are ⅛ higher; while Chelsea's City Preference and St. James's Ordinary are all 5s. to the good. The firmness extends to the provincial list, where Oxfords are in demand. It is a little singular that Metropolitans should hang fire; the price has not yet recovered from its decline of last week. Prior charge stocks in this department are good, too; and, on the whole, are more easily sold than bought.

The reassurances of Sir John Wolfe Barry to holders of shares in cable companies, to the effect that the latter are not likely to be damaged, in his opinion, by the competition of wireless telegraphy, have had a favourable influence upon the market, and there is more disposition on the part of brokers to direct their clients' attention to the good yields derivable from investment in such securities. We think it may be taken for granted that the wireless scares are practically over. There have been several during the past decade—each, however, less potent than its predecessor; and it seems fair to accept the weighty authority of Sir John Wolfe Barry on such a subject. That there should be room for both classes of enterprise has long been the opinion of the Stock Exchange market; but, naturally enough, many timid holders of cable shares have been frightened into realising as the Marconi system swept forward with giant strides.

Eastern Extensions are better on the week, and there are small rises in Anglo-American Preferred, Globe Preference, and American Telephone and Telegraph Capital stock. Various *ex*-dividend markings last pay-day were responsible for putting down a few prices to the extent of the distribution. West India and Panamas, however, recovered considerably more than the deduction, and show a rise of 3s. 9d. on the week, speculation having revived in them to some extent. Western Telegraphs are dull, and Chili Telephones eased off, while National Telephone Deferred has come in for a little selling. Business sprang up again in Marconis, the price rising rapidly on the announcement that the Company had concluded negotiations with the Norwegian Telegraph Department for the erection of a high-power station in Norway; this, of course, gave rise to whispers of another subsidiary to be formed. Canadian, American, and Spanish Marconis improved in consequence of the better tone in the price of the parent shares, business in which has been more animated than it has been for some time past.

Latin-Canadian issues tend to improve, though the movements are not very material one way or the other, being mostly confined to ½ to 1. It is thought that the situation in Mexico is distinctly clearer, and for this reason several of the issues connected with that country are a little better. Cape Electric Trams eased off 1/16. The Anglo-Argentine group keeps steady. Northern Light, Power and Coal Bonds are flat, being down to 36, a drop of 4½ points; this is a somewhat nominal movement, business in the Bonds nowadays being more or less a matter of negotiation.

The Manufacturing group is almost unchanged, the principal alteration being a fall of £1 in India-Rubber shares, which has reduced the quotation to 9½. Telegraph Constructions rose 10s. to 35½, and Castner-Kellner are better upon further consideration of the report, upon which we commented last week. Edison & Swan "A" shares slipped back to 5s. middle. No improvement has occurred in the Brush division. Rubber shares went ahead rather smartly at the beginning of the week, on the anticipation of good prices being realised at the auction sales in Mincing Lane. But the market keeps tender, and it must be said that there is not much increase in public business up to the present.

Perth Tramways Co., Ltd.—At a special meeting held on Monday, the resolutions passed at the previous meeting regarding the sale of the undertaking were confirmed.

Continental.—FRANCE.—The report of the Société Industrielle des Telephones, of Paris, for the last financial year shows a net profit of £64,194, as compared with only £61,254 in the preceding 12 months.

ITALY.—La Società Elettricita de la Sicile Orientale, of Milan, is ncreasing its capital from £400,000 to £460,000.

MARKET QUOTATIONS.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, November 20th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2¾d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16 10	..
a Copper Sulphate	„	£26	..
a Lead, Nitrate	„	£30	10s. inc.
a „ White Sugar	„	£25 10	..
a „ Peroxide	„	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	72/6	2/6 inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70/72 %)	„	£10 5	..
a „ Chlorate	per lb.	3⅝d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£90	£5 inc.
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£88 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	..
c „ Tube (brazed)	„	11½d.	..
c „ „ (solid drawn)	„	9⅝d.	..
c „ Wire, basis	„	9½d.	..
c Copper Tubes (brazed)	„	1/0⅝d.	¼d. inc.
c „ „ (solid drawn)	„	11⅞d.	¼d. inc.
g „ Bars (best selected)	per ton	£93	£1 inc.
g „ Sheet	„	£93	£1 inc.
g „ Rod	„	£93	£1 inc.
d „ (Electrolytic) Bars	„	£82	..
d „ „ Sheets	„	£99	..
d „ „ Rods	„	£87	..
d „ „ H.C. Wire	per lb.	10⅝d.	..
f Ebonite Rod	„	5/8	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	..	..
h India-rubber, Para fine	„	4/6	2¾d. inc.
j Iron Pig (Cleveland warrants)	per ton	68/-	1/3 inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£18 15	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 12 6	..
e Mica (in original cases) small	per lb.	6d. to 8s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 11/-	..
p Phosphor Bronze, plain castings	„	1/2	..
p „ „ rolled bars & rods	„	1/2	..
p „ „ rolled strip & sheet	„	1/2½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11½d.	..
Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£229 to £230	dec.
n „ Wire, Nos. 1 to 16	per lb.	3/8	..
p White Anti-friction Metals	per ton	£45 to £230	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£31 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Copper.—After the drop in price during October, principally due to general depression over the impending war, copper is again stronger, and bids fair to remain so. The European visible supplies, including Holland and Germany, stand, for mid-month, at 43,552 tons, as against 46,341 tons for the end of October (figures from Messrs. H. R. Merton & Co.'s circular). The drop includes transfer or consumption of 949 tons from English stocks, and 54 tons from French. The quantities afloat from Chile and Australia are also at a lower figure than on October 31st. Supplies from North America, for the fortnight, are above the average; from Spain and Portugal well over it, against which, of course, must be set the fact that last month's supplies from these two countries were very small. Chilian shipments are rather low, and Australian just within the average. Total deliveries, at 23,805 tons, are brisk, and, if doubled for the month, will indicate an active market. American stocks, taken from the American Copper Producers' Association, were higher for the end of October than for the end of September by 6,106 tons. The total visible supply at the end of October was 80,602 tons, the highest since April of this year.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Nov. 19th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	9¼ — 10¼	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¾	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord.	5	10	9†	9 — 9½	..	5 5 3
Do. 7 % Cum. Pref.	5	7	7	8½ — 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5†	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	..	5 0 0
Do. Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	4†	4½ — 5	+ ⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	8	6†	16 — 18	..	4 9 0
Do. 6 % Cum. Pref.	10	6	6	12½ — 14	+ ½	4 5 9
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb.	100	4½	4½	100 —103	+1	4 7 5
County of London, Ord.	10	6	4†	11¼ — 11⅝	+ ⅛	5 3 3
Do. 6 % Pref.	10	6	6	11⅝ — 12¼	+ ¼	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb.	Stock	4½	4½	98 —101	..	4 8 8
Edmundson's, Ord.	5	Nil	..	7/16 — 1⅛	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3/8 — 3/4	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	8†	7½ — 8	..	5 12 6

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Nov. 19th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Kensington & Knightsbridge, Ord	5	9	8†	7⅞ — 8⅛	+ ⅛	5 10 9
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2½	..	1⅝ — 2⅛	..	3 10 8
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4†	3⅞ — 4⅛	..	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	98 — 100	+ ½	4 10 0
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98½ —101½	..	4 18 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6†	6⅛ — 6⅜	+ ⅛	5 9 6
St. James' and Pall Mall, Ord.	5	10	10†	9⅛ — 10⅛	+ ¼	4 15 3
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 88	..	3 19 7
Smithfield Markets, Ord.	5	2	..	1⅜ — 1⅝	..	..
South London, Ord.	4	5	..	3 — 3½	..	5 14 3
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1⅛	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 11 0
Urban, Ord.	£3	Nil	..	1/16 — 3/16	..	..
Do. 5 % Cum. Pref.	5	2	..	2⅛ — 2½	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	84½ — 88½	..	5 1 8
Westminster, Ord.	5	10	9†	8¾ — 9¼	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 6 8
Calcutta, Ord.	5	8½	7†	6⅜ — 7⅛ xd	..	5 19 4
Do. 5 % Pref.	5	5	5	4 15/16 — 5 1/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	92½ — 94½	..	5 5 9
Canadian Gen. El. Com.	$100	7	7	117 —121	+1	5 15 8
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	..	⅞ — 1	..	3 0 0
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	95 — 97	+2	6 3 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	85 — 88	..	5 13 8
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	1	6	6	15/16 — 1 1/16	..	8 14 6
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½ — 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86 — 88	..	5 18 8
Mexican Lt. & Power, Common	$100	4	4†	85 — 89	+1½	4 11 0
Do. 7 % Cum. Pref.	$100	7	7	102 —105	..	6 13 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97	..	5 3 1

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	84 — 87	+1	5 15 0
Montreal, Lt., H. and Power	$100	8	9†	234 —239	..	3 15 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	34 — 38	— ½	..
River Plate, Ord.	Stock	10	..	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —111	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Shawinigan Water, Capital	$100	5	5	140 —144	+1	3 9 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 —108	..	4 12 9
Do. 4½ % Per. Deb.	Stock	4½	4½	100⅛ —102⅛ xd	..	4 7 10
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½ —101½	..	4 7 5
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	93 — 96	..	5 4 2
Victoria Falls Power, Pref.	1	11½d.	17½d.	⅛ — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103½ —105½	+ ½	5 13 9

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	..	7⅞ — 8¼	..	4 17 0
Do. 5 % Deb. Red.	Stock	5	5	96½ — 98½	..	5 1 6
American Telep. & Teleg., Cap.	$100	8	8†	146 —148	+ ½	5 8 1
Do. Collat. Trust	$1000	4	4	93½ — 95½	..	4 3 9
Anglo-American Telegraph	Stock	8	8	67 — 69	..	4 7 0
Do. 6 % Pref.	Do.	6	6	110½ —111½	+ ½	5 7 8
Do. Def.	Do.	30/-	..	25⅝ — 25⅞	..	5 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7⅛ — 7⅞	— ⅛	5 3 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	81 — 83	..	4 16 8
Cuba Telegraph	10	6	6†	9 — 10 xd	..	6 0 0
Do. 10 % Pref.	10	10	10	16 — 17 xd	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3¾ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	6⅞ — 7¼	..	6 18 0
Direct United States Cable	10	5	4	7⅛ — 7⅜	..	6 11 2
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	130 —133	..	5 5 3
Do. 8½ % Pref. Stock	Do.	8½	8½	76⅛ — 78⅛	..	4 9 2
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	10	7	7†	12⅜ — 13⅛	+ ⅛	5 5 8
Do. 4 % Deb.	Stock	4	4	97 — 99	..	4 0 10
East and S. Africa Tel. 4 % Ms. Db. Mauritius Sub.	25	4	4	98 — 101	..	3 19 8
Globe Telegraph and Trust	10	6	6†	10⅜ — 11⅛	..	5 7 7
Do. 6 % Pref.	10	6	6	12⅜ — 13⅛	+ ⅛	4 11 4
Great Northern Telegraph	10	18	18	27 — 29	..	6 4 2
Indo-European Telegraph	25	13	5†	53 — 58	..	5 12 1
Mackay Companies Common	$100	5	5†	86 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	69 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	20	..	5 5/16 — 5 7/16	+ 1/16	3 13 6
Do. 7 % Cum. Partic. Pref.	1	17	..	4⅛ — 4⅜	+ ⅛	3 9 8

Monte Video Telephone, Ord.	1	6	6†	1 3/16 — 1 5/16	..	5 13 0
Do. 5 % Pref.	1	5	5	3/16 — 5/16	..	5 14 3
National Telephone Def.	Stock	6	..	151½ —153½	—1½	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	98 — 99	..	4 10 11
Oriental Telep. and Elec.	1	8	6†	1⅛ — 1⅜	..	4 11 5
Do. 6 % Cum. Pref.	1	6	6	1 1/16 — 1 3/16	..	5 0 10
Do. 4 % Red. Deb.	Stock	4	4	89 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	10⅞ — 11⅜	..	8 16 2
Submarine Cables Trust	Cert.	6	6	126 —129	..	4 13 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½ —101½	..	4 8 8
United River Plate Telephone	5	8	..	7¼ — 7½	..	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 8 11
West Coast of America	2½	2½	..	1 11/32 — 1 13/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	1½†	3 3/16 — 3 5/16 xd	+ 3/16	..
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10½ xd	— 1/16	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9½ — 10 xd	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7†	13⅛ — 13⅝	— ⅛	5 2 9
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	98 —101	..	4 9 1

* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Nov. 19th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	13/16 — 15/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref.	100	..	..	11 — 13	..	..
Do. Do. Deferred	100	..	..	5 — 7	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	86 — 89	..	..
Do. 5 % Perp. Deb.	100	5	5	90 — 94	..	5 11 1
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	8	8†	85 — 87	+1	3 9 0
Do. Pref.	100	4	4	85 — 87	+1	4 12 0
Do. Def.	100	2	..	83 — 85	+3	2 7 1
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord.	100	1⅜	1½†	42 — 43	..	3 4 0
Do. 5 % Pref., 1891	100	5	5	107 —109	..	4 11 9
Do. Do. 1896	100	5	5	107 —109	+1	4 11 9
Do. Do. 1901	100	5	5	107 —109	+1	4 12 7
Do. Do. 1908	100	5	5	107 —109	..	4 11 9
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅜ — 2⅝	+ 1/16	Nil
Hastings Trams, 6 % Pref.	1	6	6†	13/16 — 15/16	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2⅛ — 2⅜	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	..	4 17 7
Lancashire United, 5 % Deb.	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98	+1	4 1 8
London United Trams, 5 % Pref.	10	Nil	..	5⅞ — 6⅛	+ 1/16	..
Do. 4 % Deb.	100	4	4	71 — 75	+1	5 6 8

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Nov. 19th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	100	1⅞	1½†	54⅛ — 54¾	+ ¼	2 19 4
Do. Surplus Lands	100	2⅛	2⅛†	62 — 64	—1	4 6 0
Do. 5½ % Deb.	100	5½	5½	87 — 89	..	3 16 11
Do. 5½ % Pref.	100	5½	5½	85 — 87	+1	4 0 6
Do. 5½ % Con. Pref.	100	5½	5½	84 — 86	+1	4 1 5
Metropolitan District Ord.	100	Nil	Nil	39½ — 40½	+ ½	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4 % Prior Lien	100	4	4	98 —100	+1	4 0 0
Do. 4½ % First Pref.	100	4½	4½	88 — 90	+1	5 0 0
Do. 5½ % Gtd.	100	5½	5½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5	5†	1 3/32 — 1 1/32	+ 1/32	4 5 4
Do. Def.	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % Pref.	1	5	5	13/16 — 15/16	+ 1/32	5 6 8
Do. 4½ % Deb.	100	4½	4½	93 — 95	—1	4 14 9
Do. 5 % Deb.	100	5	5	95 — 98	..	5 2 0
Potteries, Ord.	1	3½	..	3/32 — 5/32	..	..
Do. 5 % Pref.	1	5	5	3/32 — 5/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	85 — 88 xd	..	5 2 8
South Metro. Trams, 6 % Pref.	1	6	..	7/16 — 9/16	..	7 7 8
Do. 4 % Deb.	100	4	4	67 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	4⅜ — 4⅝	+ 1/16	Nil
Do. "A"	1/-	..	..	3/32 — 5/32	+ 1/32	..
Do. 6% First Cum. Inc. Deb.	100	..	6	112 —114	..	5 5 3
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	£2	90 — 92	+1	..
Yorkshire (West Riding), Ord.	5	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	5	3	..	3 — 3½	+ ⅛	4 5 9
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5⅛	5⅛	4 13/16 — 5 1/16	..	5 3 6
Do. 2nd Pref.	5	5⅛	5⅛	4 13/16 — 4 15/16	..	5 17 4
Do. 4 % Deb.	100	4	4	93 — 95	+1	4 4 3
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	99½—101½	+ ½	4 18 6
Auckland Trams, 5 % Deb.	100	5	5	103½—105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord.	5	8	8†	7 1/16 — 7 3/16	..	5 9 5
Do. 5 % Pref.	5	5	5	4 5/16 — 5 7/16	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100⅝—103⅝	..	4 7 0
B. Columbia Elec. Rly., Def.	100	8	..	144 —149	..	5 7 5
Do. Pref. Ord.	100	6	6	117 —121	..	4 19 2
Do. 5 % Pref.	100	5	5	107 —110	+ ½	4 11 0
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	100 —103	..	4 2 6
Calcutta Trams, Ord.	5	7	5†	5⅞ — 6⅛	..	5 9 10
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 8
Cape Electric Trams	1	2½	..	3/16 — 5/16	— 1/16	..
City Buenos Aires Trams (1904)	5	5†	5†	5 7/16 — 5 9/16 xd	— 1/16	4 8 0
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 2 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	8	35 — 43	..	..

La Plata Elec. Trms, Ord.	1	Nil	..	3/32 — 5/32	..	..
Do. Pref.	1	6	..	13/16 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1⅛	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	90 — 93	—1	5 7 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	112 —117	+1½	5 19 8
Do. Gen. Con. 5 % Bonds	..	5	5	95 — 97	— ½	5 3 1
Do. 6 % Bonds	100	6	6	99½—102½	+1½	5 17 1
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7 5/16 — 7 7/16	+ ⅛	6 9 10
Do. 6 % Pref.	5	6	6	5 — 5⅛	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	96½ — 98½ xd	..	5 1 6
Perth (W.A.) Elec. Tr., Ord.	1	5	5†	1⅜ — 1½	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 6	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	99 —101	..	4 9 1
Rio de Janeiro Trams	$100	5	5†	..	..	..
Do. 1st Mort. 5 % Bonds	..	5	5	101½—103½	+1	4 16 7
Do. 5 % Mort. Bonds	100	5	5	96½ — 98½	+ ½	5 1 6
Sao Paulo Tram, Lt. and P.	$100	10	10†	..	..	..
Do. 5 % 1st Deb.	$500	5	5	102½—104½	+ ½	4 15 8
Singapore Trams, 5 % Deb.	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	..	5⅝ — 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	3/16 — 5/16	..	8 0 0
Do. 6 % Pref.	1	6	6	7/16 — 9/16	..	7 7 8
Babcock & Wilcox	1	28	14†	3 — 3½	..	4 6 2
Do. Pref.	1	6	6	1 7/16 — 1 9/16	..	3 16 10
British Aluminium, Ord.	1	Nil	..	1/16 — 1/8	..	..
Do. 6 % Cum. Pref.	1	Nil	..	3/16 — 5/16	..	..
Do. 5 % Prior Lien Debs.	100	5	5	92 — 95	..	5 5 2
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	7¾ — 8	..	6 5 0
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 14 1
Do. Deb.	100	4½	4½	102 —104	..	4 4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref.	8	Nil	Nil	1/16 — 3/16	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — 1/16	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb.	100	4½	4½	30 — 34	..	13 4 8
Callender's Cable	5	15	10†	10½ — 11½	..	6 13 4
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	99½—101½	..	4 8 8
Castner-Kellner	1	20	15†	3 11/16 — 3 13/16	+ 1/16	5 5 0
Do. Deb.	100	4½	4½	105 —108	..	4 3 4

Crompton & Co.	5	Nil	..	1/16 — 3/16	..	Nil
Do. Deb.	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	Nil	1/16 — 1/8	..	..
Do. Pref.	1	6	6	1/16 — 1/8	..	6 8 0
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £5 paid	5	Nil	..	1/16 — 3/16	— 1/16	Nil
Do. fully paid	5	Nil	..	1/16 — 2	..	Nil
Do. 4 % Deb.	100	4	4	65 — 69	..	5 16 0
Do. 5 % Second Deb.	100	5	5	72 — 75	..	6 18 4
Electric Construction	2	2½	3⅛	1/16 — 1 1/16	..	7 1 4
Do. Pref.	2	7	7	1 1/16 — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb.	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12 — 12¾	..	6 13 4
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 9 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	9 — 10	—1	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	17½	5†	84½ — 86½	+ ½	5 14 9
Do. Deb.	100	4	4	97 —100	..	4 0 0
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	1/16 — 1/8	..	Nil
Do. Deb.	100	4	4	58 — 60	..	6 13 4

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

MORE NOTES ON ELECTRIC WELDING.

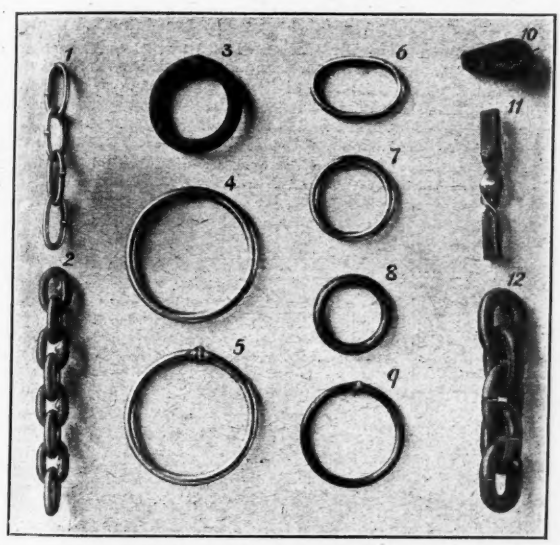
By V. D. GREEN.

(*Continued from page* 807.)

As the percentage of carbon increases, the difficulties of making a successful weld increase also, and the settings have to be more and more accurate. But the sample before you will show that even a fairly large amount of carbon does not altogether preclude welding. This piece was originally of a ½-in. square section and was welded for a client of ours as a demonstration. It contains about 5 per cent. or more of carbon and will harden in air to such an extent that we found it very difficult to file or saw unless cooled down very slowly. After welding, we sent it to our customer who reheated and forged it into a strip $\frac{3}{16}$ in. by ⅜ in. wide, and then bent it over with a hammer while cooling. He admitted that his own smiths could never weld the material at all.

I have also here a sample of common iron and mild steel welded to tool steel. The application of this to the manufacture of tools and cutlery is evident.

With copper, one encounters the difficulty that it must be raised to a much higher temperature than iron before it will weld, and that it then oxidises very readily. Unfortunately, too, its melting point is nearly the same as that of iron, so that its



1, Bridoon chain (links unswaged); 2, chain links welded and swaged; 3, mild steel harness ring welded; 4, nickel "rustless" harness ring welded and swaged and finished; 5, nickel "rustless" harness ring welded and swaged; 6, nickel harness ring flattened to show strength of weld; 7, mild steel harness ring nickelled and finished; 8, mild steel harness ring ready for welding; 9, harness ring welded and swaged (mild steel); 10, weld in air-hardening steel, forged and bent hot; 11, flat strip, mild steel, welded and twisted while hot; 12, chain links linked up ready for welding.

Fig. 3.—Group of Electrically-welded Articles.

liquefying and welding temperatures are very close together. Very accurate setting of the machine, therefore, becomes imperative. Brass and nickel have all the difficulties of copper plus several special troubles of their own. The worst is the tendency of the zinc to volatilise before the copper constituent has come up to the welding heat. The chief trouble incidental to the welding of silver, lead, aluminium and other metals of the same group is their affinity for oxygen, especially when heated, and this necessitates the temperature being kept as low as is consistent with obtaining a good weld. It is curious, by the way, that silver, which can readily be welded by a jeweller's blow-pipe, is very difficult indeed to weld electrically. This is quite a reversal of what one usually finds.

We must now leave the subject of the welds and welding conditions, and go on to the question of the welding machines themselves. As has been already mentioned, the "resistance" system of welding involves the use of very heavy currents at an exceedingly low electrical pressure, and the plant must, therefore, be designed to produce these economically. It is largely for this reason that alternating currents are employed, so that the power may be generated at a comparatively high pressure where convenient, and fed into a transformer which will change the energy supplied to it into the low pressure form suitable for welding. It is true that during the early stages of electric welding the original Thomson Co. took out a patent for a special low voltage dynamo in which the welding current was generated without using a transformer at all, but as it necessitated mounting the welder immediately over the alternator, and led to all sorts of expense and trouble on account of the low voltage and consequent cost and complication of the armature and field windings, it was soon abandoned. In fact, I doubt whether it was ever seriously intended to be anything but a "blocking patent."

The original apparatus described by Prof. Thomson in his specification was curious, and in view of what is now known about transformer design not specially efficient. The core was a circular iron ring presumably laminated. Outside this was the secondary coil consisting of a single turn of cast copper hinged in the middle and terminating in two split sockets which could be tightened by means of screws on the work. A powerful spiral spring tended to pull the two halves of the coil together for the purpose of upsetting the weld, and an adjustable stop pin on one of the jaws limited the amount of "shove." Crude though this apparatus was, however, astonishing results were obtained compared with the older fire-welding method, and it was not long before improvements were

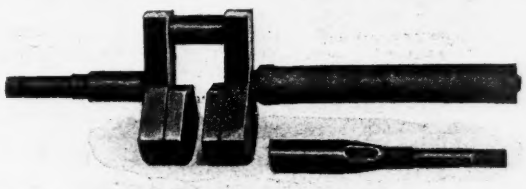


Fig. 4.—Broken Crankshaft Repaired with Electric Butt Welder.

made enabling the Thomson process to leave the "scientific toy" stage and to take its part as a factor to be seriously reckoned with in the industrial world.

It was soon obvious that some method of regulating the secondary voltage was urgently necessary. The pressure, which was quite insufficient for a 1-in. square bar, was enough to blow a ¼-in. rod to pieces before the current could be cut off. Where, as was generally the case at first, each welder had its own dynamo, field regulation on the generator gave all the variation which was required, especially as very exact results were not regarded as essential at this stage of the evolution of the process. But when several welders were installed in a single works, it was necessary to have a separate control for each welder. Probably the first method adopted was placing a resistance in series with the primary winding of the transformer. I have on occasions used this myself as an emergency method, but, beyond the advantage that it does not pull the alternator voltage about quite so much as a choking coil, it has very little to recommend it. From this to a choking coil was an obvious step. This method was more economical than a resistance, and even now is unrivalled for certain work. Another method is to have tappings in the primary windings, and this has also advantages (principally where the heat is to be concentrated as much as possible).

The original method of applying the upsetting force was also open to grave objections. To begin with, a hinged joint through which, say, 10,000 amperes have to pass is not a particularly satisfactory affair. Moreover, the electrical pressure is so low that more than 50 per cent. might quite conceivably be wasted through imperfect contact, due to pitting caused by the enormous currents used crossing from one half of the hinge to the other. Also it was felt that the horseshoe design of secondary was not very convenient for handling, because on account of the exposed primary coils the apparatus had either to be suspended from a chain or propped up on the floor. The horseshoe form, therefore, is now almost exclusively confined to tram rail welders which are slung from a crane. Under these modifying influences the secondary coil was inverted and cast solid in one piece, and was fixed to the underside of an iron table suitably insulated, the primary and core being arranged underneath and the whole cased in for protection. The ends of the secondary were milled out "V" shaped and carefully scraped flat. On these a pair of massive copper slabs were mounted, carrying renewable dies and having hand wheels for screwing down the work between clamps. Although the sliding surfaces were still

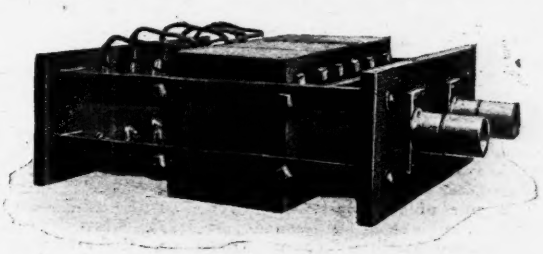


Fig. 5.—Chain Welding Transformer

retained, this method minimised the risk of bad contact by greatly increasing the area of the joint through which the current had to pass. Even this, however, had its disadvantages. I remember on one occasion when assembling a welder of the earlier type I found it impossible to make it work at all on account of the sliding surfaces having got oily. The method which we invariably adopt except in very small sizes is to connect the jaws directly to a flexible secondary built up of thin laminations, and this overcomes the trouble altogether, for there are no sliding surfaces to carry current at all.

As the method of applying the pressure to produce the "upset" through a spring direct made it difficult readily and quickly to open

the jaws to the necessary amount, a lever, or toggle and lever, was next added.

The original type of limiting stop for controlling the amount of "upset" proved very unsatisfactory for the higher welding speeds which increasing competition rendered necessary. It certainly prevented the "upset" from being carried too far, but there was the danger that unless the welding current was stopped simultaneously, the weld would burn through owing to want of mechanical pressure. What was wanted was a device which would cut off the

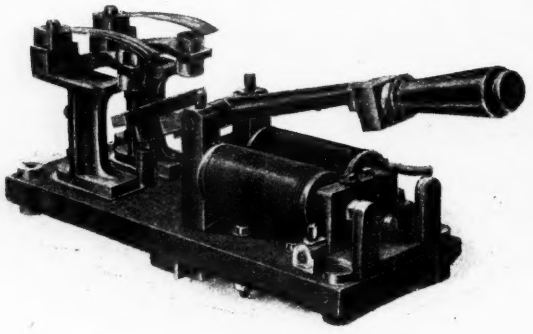
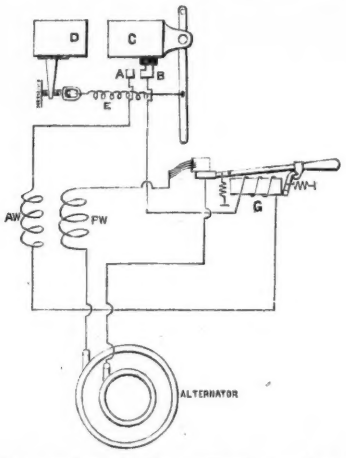


Fig. 6.—Thomson Welding Switch.

current automatically at the right time, and probably no other part of a welder has received so much attention as this one. The most obvious thing was a switch in the primary circuit which, when forced by the hand into the "on" position, engaged with a catch, which kept it closed.

A pin on the movable we'der jaw was so placed that when the predetermined "upset" had taken place, it tripped the catch off a knife edge and allowed the switch to open under the influence of a strong spring. This was an enormous improvement, and enabled the speed of working and the accuracy obtained to be much increased. Unfortunately, it was a most inconvenient thing to



A, B, Contacts; C, D, Jaws of welder; E, Upsetting spring; G, Control switch; A W, F W, Auxiliary and primary windings of transformer.

Fig. 7.—Diagram of Connections of Thomson Switch.

have a high pressure switch close to the welding heads and to remove it out of the way and yet link it up accurately to the welder jaw increased the expense and complication to an undesirable extent, as, of course, every additional link or member increased the backlash and consequent inaccuracy of the control.

The next stage of evolution was an electrically-operated trip-gear, such as the one you see before you (fig. 6). A special winding is arranged on the transformer which is allowed to send current through the magnet coils of the switch when the circuit is completed by means of a pair of insulated contacts, one on the frame of the machine, and one on the movable jaw (fig. 7). When the handle is depressed and the current turned on, the armature of the magnet falls forward and a knife edge engages with a catch on the handle lever. When the proper upset has taken place the contacts on the jaw and frame come together and allow current to flow from the auxiliary coil on the transformer through the magnet, which attracts the armature backwards and releases the switch. This enables the switch to be put anywhere on the machine that happens to be convenient, and so far it has the advantage of a purely mechanical switch. But there is one great drawback common to both. No matter how hard the steel of the knife edge and catch may be, there is bound to be some wear, and when it is considered that a welder may make 4,000 or 5,000 welds a day, it will not surprise anyone to learn that the wear will very soon be bad enough to upset the accuracy of the cut-off—long before the working parts have arrived at the "scrapping" point. The fact that the device is electrically operated does not help matters in this respect; in fact, it makes them rather worse, because in addition to the errors due to mechanical wear, there is an uncertain lag caused by the time required first to saturate the armature and then to pull it up against the magnet face. What is wanted is something which shall have a very small wear, and which will keep its adjustment unaltered up to the end of its useful life. In order to attain as near as

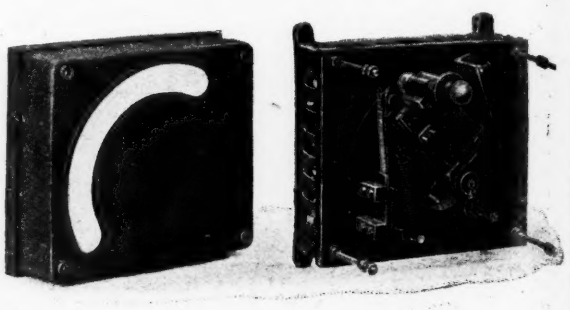
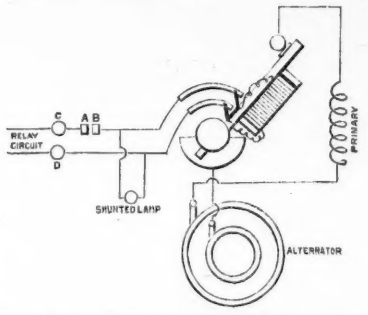


Fig. 8.—Green's Patent Automatic Switch.

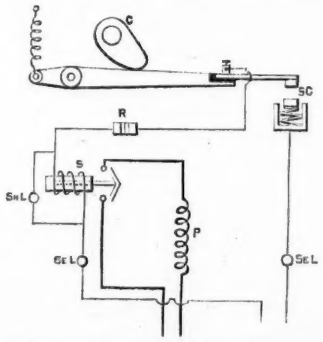
I could to this ideal I designed and patented a switch which, after careful testing, my firm, Messrs. Pontelec Welding Patents, Ltd., have adopted for use on their high-speed machines. It was evident from the start that all trip gear must go, and the working of the switch must be electrical throughout. The switch (figs. 8 and 9) is of the radial type, because every time contact is made or broken there is a rubbing action on the contact stud which tends to keep it clean. Dirt is the first stage towards pitting, and the rapid destruction of the stud. This stud is readily renewable. In the type before you there are two levers. The first, or contact lever, carries a pair of liberally rated brushes, one brass and the other carbon, each having a separate spring feed to allow for wear. A strong spring tending to pull the lever off the contact is attached at its outer end to a



A, B, Contacts on jaws of welder; C, D, Lamps in series with magnet coil.

Fig. 9.—Diagram of Connections of Green Switch.

stout iron pillar on the slate base. The second lever carries the handle, and has mounted upon it a powerful electromagnet having faced iron cheeks which, on one side, are adapted to bed on to a loose armature on the contact lever, and, on the other, make magnetic circuit through an angle-iron stop piece, which limits



C, Closing cam; S C, Spring contacts; R, Relay breaking contacts on jaws; S, Solenoid switch; P, Primary of welder; SH L, Shunted lamp; SE L, Series lamps.

Fig. 10.—Diagram of Connections for Automatic Welder.

the travel in the "make" direction. This lever has also a spring tending to pull it in the same direction as the contact lever, but it is only strong enough to ensure its coming away from the iron stop-piece with certainty. A pair of quadrants feed the magnet circuit through a pair of spring plunger contacts, and a flat compound buffer spring is provided on the slate base to take up the recoil of the two levers. On the fixed portion of the welder jaw are two small contacts, which are normally kept pressed together by a weak spring. One contact is attached to a sliding bar, which carries a projection on the other end. An adjusting screw on the moving part of the welder jaw presses against this projection when the correct upset has taken place, and continuing

its travel carries the bar with it, thus separating the contacts. The electrical connections are as follows: The main primary circuit of the welder passes from the A.C. mains to the main contact of the automatic switch, through the primary windings of the transformer, to the mains again. The relay circuit, which may either be taken from the same source as the main primary circuit, or, where an alternator, motor-generator or rotary converter is used, from the D.C. supply mains or from the exciter, passes through a carbon-filament lamp to the magnet coil of the switch, from thence to the relay contacts on the jaws, through another carbon-filament lamp, back to the supply. Across the magnet coil a tantalum lamp is shunted. The action of the switch is as follows: When the welder jaws are pressed back to their proper position and the weld inserted, the contacts on the movable jaw are closed by the spring, the switch magnet is energised and the signal lamps light, showing that all is ready for turning on the current. One lamp is by the side of the operator and one is usually arranged to act as a tell-tale in the foreman's office, thus enabling the speed of working to be checked without the foreman having to leave his desk. If preferred a counting device registering the number of welds made could be substituted. The handle lever of the switch is then

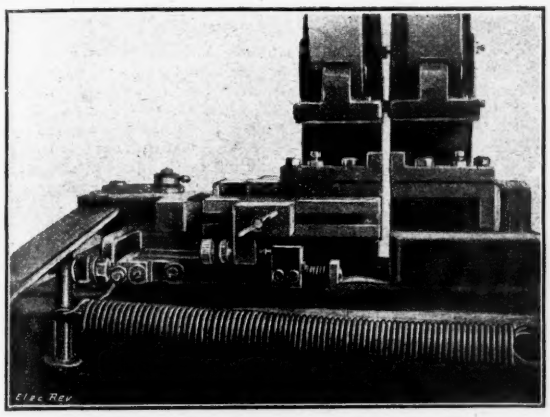


FIG. 11.—ORIGINAL TYPE OF BUTT WELDER JAWS, SHOWING RELAY CONTACT GEAR OF PATENT SWITCH.

pushed "on," and by means of the electromagnet it pulls the contact lever over with it, both levers being thus held against the angle-iron stop-piece by the attraction of the other face of the magnet. As the metal in the jaws becomes plastic the upsetting spring forces the jaws together, and the pin on the movable jaw engages with the projection on the contact bar, thus separating the contacts and de-energising the switch magnet, when both levers are pulled to the "off" position by their springs. It is evident that the amount of accuracy obtained depends upon the length of the spark formed between the jaw contacts when drawn slowly apart by the upsetting metal and by the length of time taken for the switch magnet to de-energise—that is, on the amount of self-induction in the circuit. The series lamps in the relay circuit reduce the proportion of inductance to resistance, and the lamp shunted across the magnet windings takes up the inductive discharge from the coil and ensures instantaneous release. The net result is that the spark at the jaw contacts even on 440 volts is almost unnoticeable. Moreover, this control system has the advantage of being foolproof. There are two ways in which a careless operator can spoil a weld. He may fail to press the jaws back to the stop-pin which limits the backward travel. In this case the upsetting spring would force the jaw to the forward end of its slide, and if the current were applied to the stock, the jaw already being at the limit of its upsetting travel would not "follow up" the softening metal. The weld would then burn through. But it will be seen that if the jaw is at the wrong end of its travel, the relay circuit is necessarily broken, and it is therefore impossible to pick up the contact lever of the switch and so make circuit through the transformer. The other alternative is that the operator may fail to let go the switch handle before the upset has reached the pre-determined point, especially if the speed of welding is high. In this case if left to itself the weld would upset right to the end of the jaw travel and then burn through. But as soon as the relay circuit is interrupted the magnet is de-energised and the contact lever is released independently of whether the handle is held or not.

"The proof of the pudding is in the eating—or in the digesting," and I was assured by a firm for whom we had installed a plant a little while back that during the first week of running it they had made no scrap, though their operator was not an experienced hand; in fact, I doubt whether he had ever made the acquaintance of an electric welder before. All that happened was that the machine declined to go on until the cycle of operations was correctly carried out. The errors described above do not seem very likely to occur, but in practice, with unskilled operators and high working speeds, they do happen fairly frequently.

Of course, difficulties cropped up in connection with the first one or two switches, but, curiously enough, they did not occur over the electrical action, but over the mechanical details. It is difficult to realise the terrific strains which are put upon the switch of a welding machine, both by normal working and by the careless methods of the user. One would not readily imagine that an operator would slam the switch on violently enough to break the slate base and the cast-iron lever, or that he—or, as is usually the case, she—could break a ½-in. stop-pin through, but I have known both these things happen. These troubles may doubtless be attributed to the "fatigue" of the material due to the incessant jarring. However, we have not heard of anything lately beyond fair wear and tear, and it is pretty certain that we should have done if there had been trouble.

(*To be concluded.*)

ERRATUM.—In fig. 2, p. 806, the middle curve relates to ½-in., not 1½-in. rod.

PROCEEDINGS OF INSTITUTIONS.

The Institution of Electrical Engineers.

(*Abstract of Inaugural Address delivered in London, November 14th, 1912.*)

By WILLIAM DUDDELL, F.R.S., President.

THE Institution is installed in its new home; it has revised its articles of association, and it is now prepared, having got these matters out of the way, to undertake its proper functions with regard to the electrical industry. There is a wide field of work to be undertaken, on the one hand, in encouraging the publication of scientific technical knowledge; and, on the other, in looking after the interests of the electrical industry.

Eight years ago, when it became evident that the finances of the Institution would shortly allow us to have a building of our own in which a proper library could be fitted up, the Institution started to bring the library up to date, a work which is now nearing completion. The combination of the older works which were collected by the late Sir Francis Ronalds, and modern works which the Institution has obtained either by gift or purchase, forms a library which outrivals any other library of electrical literature, certainly in this country, and possibly in the world. The classified section of modern technical books is very complete. I hope that at a not distant date we may acquire a sufficient duplication of modern works to enable the Institution to lend them to those members who cannot conveniently visit the library.

Another subject which I wish to invite the members to support is the Institution Museum. One of the great difficulties in making a museum is that when things are in common use everyone thinks that they are of no importance to a museum, and directly they go out of common use and begin to become historically interesting, one finds that all the examples have been destroyed and that they are no longer obtainable. I should like, therefore, to personally appeal to the members of the Institution to present to the museum examples of present-day apparatus as they become obsolete, so that they may be preserved for future generations rather than that they should be melted down as scrap.

With regard to the progress of the Institution, latterly so much has been said and written, and my predecessor in office has so fully explained to you our aims, that I think I cannot do better than endorse his views without adding anything.

I want to take this opportunity of voicing a warning against this Institution becoming narrow in its ideas, and limiting itself too much to one branch of the electrical industry. The Institution of Electrical Engineers should, according to my view, embrace in its discussions and papers all matters dealing with electricity. I think I have noticed a tendency of late years to limit more and more the papers read before the Institution to one class of subject. The tendency is to bring before the Institution papers mainly dealing with generation, distribution, and the cost of electrical energy, and in many cases only dealing with these as large general questions.

Of the 6,600 members the proportion must be very small who have the actual scheming or designing of large things. The great bulk of the profession must naturally be occupied in working in their own groove in life. These members have very little chance at the present time of discussing their own special subjects. Details—small things—are very often of the greatest importance. In many cases the success of a big scheme or a big plant mainly depends upon the attention that has been bestowed on its detail. I trust that during the coming session members will bring forward for discussion many subjects which might be looked upon under the old ideas as not being of sufficient importance to discuss at a general meeting of the Institution, but which can be discussed with advantage at the informal meetings which it is proposed to hold.

The tendency to restrict the subjects brought before the Institution is not good for the profession nor for the Institution. To attain that much desired and talked-of progress in the application of electricity, and with it the advancement of the industry, it is necessary for all engineers to take as wide a view as possible of everything that concerns their profession.

We hear little, if anything, about what is occurring on what I may term the borderland between electricity and the other sciences. In this borderland or fringe a large number of scientific workers are quietly at work, and what is to-day a laboratory experiment may to-morrow form the basis of a large industry.

Probably from the point of view of the amount of money invested and number of men employed, the original work of this Institution occupies the first rank. I refer to telegraph engineering. It is curious, considering the importance of the subject, how few papers

dealing with telegraphy have been read before us. We have had, during the last 10 years, only 12 papers dealing with this subject, in a total of 400 papers and addresses published in the *Journal*. I do not think that this can be said to be due to the fact that there is nothing new to describe. A great deal of work has been going on in telegraphy and telephony, and a steady and real progress has been made.

It is difficult to obtain figures of the amount of money invested in the telegraphs and telephones of this country, but if we take the original sum of money paid by the State when it purchased the telegraphs, and the amount of money spent on its extension, together with the money spent by the Post Office and the National Telephone Co. for the telephones, the sum is probably well over £100,000,000, and the number of employés probably exceeds 100,000.

Electric signalling on railways may be looked upon as a form of telegraphy in which most striking advances have been made in the last few years.

I cannot leave the subject of telegraphy without mentioning the progress that is being made in the art of wireless telegraphy. Since Signor Marconi read his paper on wireless telegraphy before this Institution in 1899 we have had a number of papers dealing with different parts of the apparatus, but we have not had a general review of the subject. The principles are well known.

There seems no doubt that long waves are more suitable for long-distance transmission, but the question is far from settled as to what is the best wave-length for long-distance work, or even whether there is such a thing as a best wave-length for any given distance.

What is a suitable wave-length; or, in other words, what is a suitable frequency to use in the antenna? This most fundamental question is, I believe, as yet unanswered.

The engineering problems which confront us at the transmitting end are the design and support of the aerial conductor, the machinery to produce in it high-frequency currents of one definite frequency and of considerable power, and the mechanism for cutting up the high-frequency currents to form the dots and dashes of the Morse code. The changes that have taken place in the design of the aerial have been mainly in two directions, the one to make it more suitable for the longer wave-lengths now in use, and the other to give the aerial such a shape that the radiation may be much stronger in one direction than in any other. The first desideratum is obtained by extending the height of the aerial and by increasing the capacity of the condenser formed by the upper part and the earth. Of the directive aerials the Marconi type, consisting of a comparatively short vertical part and a much longer horizontal part, is the only one that has come into use for long distances. As an example, the aerials proposed for the Imperial wireless scheme are to be 300 feet high and apparently some two or three thousand feet long, supported by ten steel masts. The design of an inexpensive form of mast to carry the aerial is a difficult engineering problem.

The type of generating plant depends upon the system employed, and here it is necessary to distinguish between the two forms which the high-frequency currents in the aerial may take.

In the first form the amplitude of the high-frequency current in the aerial starts from zero, rises rapidly to a maximum value, and then dies away again. In the second form the current is of constant amplitude exactly similar to that produced by an alternator. Considering the first and older form the oscillations are produced by the sudden discharge of a condenser through a small self-induction. If the condenser be charged by means of an alternator, in general one discharge will be obtained across the spark-gap with the corresponding train of oscillation during each half-period, thus the number of trains of oscillation per second is equal to twice the alternator frequency. This number can be varied by suitable adjustment.

If we have a given amount of energy to transform per second, the higher the spark frequency the less the energy to be dealt with at each spark. Further, for a given size of condenser, the less the energy the less the voltage to which it will have to be charged. Hence, there are certain advantages in the high spark frequency and a further advantage will appear when we consider the receiver.

The spark frequency has gradually increased from 10 to 20 per second with the induction coil, to 100-200 per second, corresponding to commercial alternating supply currents, and up to 1,000-1,200 obtained from special designs of alternators.

A method much in use for obtaining a high spark frequency from an ordinary, say 50-frequency supply, is to employ a rotating spark-gap or discharger. The apparatus consists essentially of a number of revolving electrodes, which in turn come between the fixed electrodes of the spark-gap and cause discharges to take place, shortening the sparking distance. The number and speed of the revolving electrodes is so chosen as to give the required spark frequency. If such a discharger is used in connection with a continuous current, as is done at Clifden, one discharge is obtained each time the electrode or stud passes between the fixed electrodes of the gap.

One great advantage of the revolving type of discharger over the older fixed gap is that the windage on the electrodes keeps them cool and blows away the conducting gases formed at each discharge, so that the gap rapidly passes from the conducting into the insulating condition. This is a matter of great importance, for if the gap did not rapidly recover its insulating properties an arc would be formed which would prevent the condenser being fully charged again. A number of methods of cooling the electrodes and gases of the spark-gap have been devised. One, which is being largely used by the Telefunken Co., consists of making the spark-gap of a number of flat metal disks, separated by extremely small air-spaces of the order of a tenth of a millimetre, so that the cooling action of the disks on the gases between them is very great. This cooling action causes a rapid extinction of the discharge called "quenching." Quenching is of great value in reducing the reaction between the oscillations in the aerial and those in the condenser circuit, thus enabling tighter coupling to be used and a pure radiation to be obtained. This system, due to Prof. Wien, is spoken of as the Wien or Shock excitation system.

A number of ingenious methods have been proposed in which advantage is taken of the fact that a condenser takes a certain time to charge through a resistance to a given voltage.

If a high-voltage continuous-current supply is available, and a condenser be connected to it through a resistance, the condenser will charge to any voltage less than the supply voltage in a definite time depending on the value of the resistance. If the condenser be also connected through a self-induction to a discharger in the ordinary way, then discharges can be obtained at regular intervals, depending upon the time the condenser takes to charge. It is quite easy to vary this time over a very wide range, say, from one discharge per second to 100,000 per second, provided the spark-gap becomes insulating sufficiently quickly after each discharge. Mr. Galletti has coupled together a number of circuits on the above principle to enable large powers to be dealt with, and he informs me that he is now erecting near Lyons, in France, a transmitting station on a large scale. The results of the tests of this station will be extremely interesting.

Turning next to the continuous oscillations, the arc method has been longest in the field. The principle is well known to you, as it was described before this Institution in 1900. It consists in shunting an unstable arc with a self-induction in series with a condenser when, if the conditions are suitably adjusted, high-frequency oscillations take place in the condenser circuit of practically constant amplitude. Since then Poulsen and his colleagues have founded a practical system on this principle, and considerable progress has been made, although the system has not come into commercial use in this country. The engineering difficulties of the system appear to consist in maintaining the arcs, by means of which large powers are being transformed, so perfectly regulated that the output of high-frequency current is constant both in strength and in wave-length.

High speeds, over 100 words per minute, have been attained in tests of this system between Copenhagen and Cullercoats in England. I am informed that a number of commercial stations have been recently opened on the west coast of the United States, and that good communication is now being obtained by night between San Francisco and Honolulu, a distance of 2,360 miles, with only 25 KW. The stations have masts rather over 400 ft. high, and they are now being equipped with arcs to transform much larger powers.

(To be concluded.)

The Turbo-Converter: a High-speed D.C. Generating Unit.

(*Discussion on paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Manchester, by* F. CREEDY, *November 5th*, 1912. *See* ELECTRICAL REVIEW, *p.* 765.)

PROF. MILES WALKER said it was his experience that commutators could run at something like 10,000 or 11,000 ft. per minute without any difficulty whatever. The difficulties which had arisen in turbo-generators were due not to the high speed of the commutators but to the fact that sufficient provision had not been made for expansion and contraction. If a commutator was running perfectly true (and the radial-face commutator could be made to run true for years), in the mere fact that it was running at 3,000 R.P.M. or the commutator at 10,000 ft. per minute, there was absolutely nothing against it at all. There were in this country machines delivering thousands of amperes which ran at speeds of 2,000 to 3,000 R.P.M. from year to year. He could show the author a brush that had run for 18,000 hours, practically three years, and the brush had only worn ½ in. It, therefore, gave a false impression to say that high-speed commutators could not be built. In a certain works in Sheffield there was a very cautious engineer who decided to put in a machine with carbon brushes, running at 2,000 R.P.M. After he had had that 500-KW. machine he went in for a 1,000-KW. unit, and that machine was running continuously pouring out 4,000 amperes at 2,000 R.P.M. The Cunard Co. decided to use a radial type commutator continuous-current turbo machine on their ships; what they wanted was something that did not require much attention. There were machines in Manchester built by Siemens which were running in a thoroughly satisfactory way. One member of Mr. Creedy's machine was nearly twice as large as the one at Sheffield. The copper losses were only ·3 in a continuous-current machine, whereas Mr. Creedy's were ·75. The machine could not be built any smaller than the rotary converter.

MR. J. S. PECK said he could hardly understand how any mechanical man could accept a design such as that shown for a commercial machine. First there was a converter with both parts rotating. Then the machine was coupled through a jockey shaft and through fast and loose pulleys to another machine, and the whole combination as given looked to be perfectly hopeless as a commercial and practical machine. The D.C. turbo-generator was, in his mind, no ideal, in spite of what Prof. Walker had said. The tendency on the part of the turbine manufacturers was always to speed the machine higher and higher, so that he believed the final solution of the problem of driving large D.C. generator at very high speeds would be either through a gear reduction or through some other reduction, such as a rotary con-

verter and an A.C. generator. Mr. Creedy had shown a speed reduction of two to one; if he used some other speed to get a higher speed on the turbine and a lower speed on the generator, or both, the advantage claimed of the capacity of two to one no longer held.

MR. W. CRAMP said Mr. Ferranti told him, at least 15 years ago, that one of the first generators he built had a rotating armature and field, and he still believed in that principle, if it were not for the difficulties to be overcome in the matter of bearings. It might be possible, in his opinion, that the overhung bearing would be adopted. Overhung bearings had been used successfully, and one German company put on the market some 10 years ago a line of motors consisting of ring armatures in which both the inside and the outside of the ring armatures were made use of. There was a line of motors on the market, made in Canada, and used in small cars, in which the armature drove one wheel of the car and the rotating field drove the other wheel. The motors had been used for many years, and were successful. It gave a very small motor with comparatively few turns in the armature at a comparatively high speed.

MR. G. W. WORRALL thought the difficulty with a D.C. turbo-generator was not entirely in the commutator, but, to a very great extent, between the commutator and the armature. He had come across two serious breakdowns; the first was due to broken commutator sections, a trouble which manufacturers now claimed to have overcome (and in turbines that had come under his notice of the newer type he had not had the same trouble); the second was the formation of a layer of dust between the connections between the commutator and the armature. It was almost impossible to get the dirt out because the little bits that got in hardened, owing to the terrific speed, and formed a solid mass. When the armature itself broke down it was an expensive thing to repair, and so one was rather inclined to consider slower speeds. In spite of the many difficulties in Mr. Creedy's invention, it should be very seriously considered, in view of the fact that the D.C. part could be run at a lower speed, and could easily be cleaned.

MR. A. E. MCKENZIE said that the high-speed turbine driving through single-reduction gear a continuous-current generator would be preferable to the arrangement shown in the paper. He knew of a turbine which had been running for over 12 months almost continuously at 7,500 R.P.M., driving a pump through a single-reduction gear, ratio 10 to 1; it might be a continuous-current generator for all the turbine knew about it, and if it was the aim of most turbine builders to get a high speed, then surely a speed of 7,500 R.P.M. was sufficient. This pump, after working continuously for over 12 months, showed no sign of wear at all; it was exactly the same as when put in. A firm of engineers had put forward a proposal for a 3,000-H.P. turbine which would run at 3,500 R.P.M. and would drive a 1,800-KW. D.C. generator through a single-reduction gear at 1,000 R.P.M. He had no doubt it would be made a perfectly satisfactory job. Regarding the machine the author had put forward, those who had been unfortunate enough to deal with large units which had been subjected to very heavy short-circuits would not look with very great favour upon the mechanical design of the stator.

MR. J. PURRETT said he would like to know how the cost of this machine would compare with existing arrangements for producing similar results. It appeared to him that in a machine such as the one described, reliability was being considerably sacrificed.

THE AUTHOR, in reply, said he did not dispute that the high-speed commutator was possible. The turbine taken by Prof. Walker rotated at 3,000 R.P.M.; the one described in the paper only ran at 1,800. If Prof. Walker's machine was designed for the latter speed, it would be nearly the same size as the one shown. The question was whether this machine was cheaper than a mechanical gear with a full-size generator. If it was not, then, of course, the gearing had it.

Institution of Electrical Engineers (Western Local Section).

ON Monday last, MR. W. A. CHAMEN read his inaugural address as chairman of the Section, at Cardiff. He said that, at a rough estimate, the total horse-power of motors and lighting and heating devices installed in the area served by the Western Section could not be less than 260,000 H.P. The membership of the Institution within the area was small, the total being 212, of whom 117 were Associate Members. There must be many electrical engineers and other persons who were eligible for admission, within the Western district. The new "Graduate" class should attract large numbers, and every endeavour was being made to remove the objection that those living in the district could obtain no benefit by joining the Institution.

After enumerating the various purposes to which electricity was applied in the West, Mr. Chamen considered the possibilities of development in other directions. The adoption of railless traction would be welcomed by users of the roads, but in order that it might be carried on satisfactorily, the roads would have to be kept in better condition. The storage battery might yet be found a very useful friend in districts where electricity supply was continuously available, and the modern improvements in battery vehicles appeared to open up possibilities well worth the serious consideration of those who were contemplating the introduction of railless traction. Motor-'buses, carrying 36 people, and capable of running 45 to 50 miles without recharging, with replaceable accumulators weighing about 1 ton, had been produced, and the cost of maintenance of the accumulators seemed to have been reduced to quite a moderate figure. The simplicity of the whole equipment, and the perfect control of the vehicle made this method of traction a most fascinating one. Pointing out the various advantages of electric traction on railways, Mr. Chamen outlined the three chief methods of carrying it out, remarking that each had its advantages under certain circumstances. The use of electricity for stimulating the growth of crops and plants was briefly discussed, and the chairman expressed the opinion that as electricity supply became more generally available, considerable developments might be made in this direction. The importance of the subject was emphasised, in view of the inadequate production of food stuffs in this country.

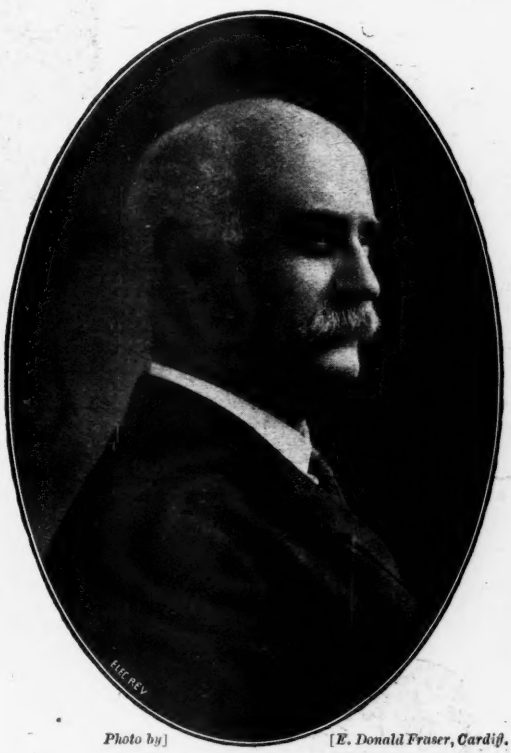


Photo by] [E. Donald Fraser, Cardiff.

W. A. CHAMEN,
Chairman of the Western Local Section of the I.E.E.

Turning to the question of the supply of electricity, Mr. Chamen pointed out that where this was available small plants could be economically operated by electricity, such as an automatic sewage pumping installation near Cardiff, small water supplies, &c. He expressed surprise at the difficulties which were placed in the way of electricity supply companies by persons who might be expected, in their own interests, to assist the companies in every way, and he advocated the creation of statutory powers to confer upon the latter the right to go across any property within reason, paying compensation for any genuine injury suffered by the landlord thereby, as in Italy and Switzerland.

Local authorities raised unnecessary difficulties, and in many instances had prevented the introduction of electricity supply within their districts without sound reason. It was to be deplored that there was such a want of trust in the good faith of the directors of companies; the conditions laid down by Parliament and the Board of Trade provided ample safeguards for the public. The local authorities had an absolute veto against the erection of overhead electric lines, without appeal to the Board of Trade; this was apparently an oversight, and should be remedied. In several cases, however, the local authorities had co-operated with the power supply companies on reasonable terms.

In one instance a U.D.C. was putting down a refuse destructor with electric generating plant, and would supply energy to the mains of the power company at an agreed price; on the other hand, the U.D.C. had agreed to take bulk supplies of electrical energy at various parts of the district, through which the transmission mains already ran, and would itself distribute the electricity. The arrangement provided a market for the Council's waste energy at all times of the day or night, while affording a supply of energy when required at a moderate price, and saved the cost of transmission. In another instance a U.D.C. had agreed to the company obtaining a prov. order for the supply of the district, and had arranged for the electric lighting of the roads and streets. It was to be hoped that these beginnings of better understandings between companies and Councils would spread as time went on.

Several large colliery companies in the district of the South Wales Electrical Power Co., where the mains of the latter were not yet extended, had put in their own plant, but had chosen the same periodicity as that of the Power Co., with a view to linking up for mutual advantage in the future. Thus the surplus power available at one colliery could be utilised at another, and so on. Points such as these showed that there was much work for the Institution to take in hand, which was purely commercial and untechnical, but was nevertheless of the very highest importance to the development of the uses of electricity.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Automatic Temperature Control.

In connection with some remarks made by us on page 687 respecting the prospects of automatic temperature control in conjunction with electric heating, we have received from the Geissinger Regulator Agency, of 7, Redcross Street, Liverpool, some particulars of the Geissinger system of temperature control of electric heaters which has been applied in connection with the temperature regulation of the magazines on the latest U.S. battleships, on the trains of the New York Central Railway's electrified

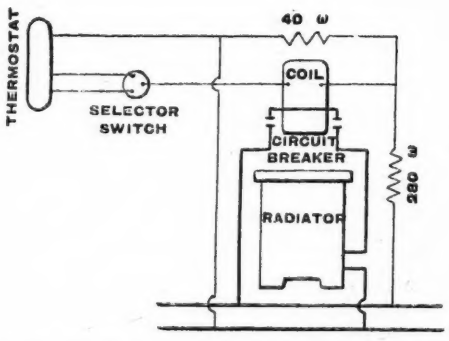


Fig. 1.—Diagram showing Connections of Thermostat, Automatic Switch and Heater, Geissinger System.

system, and on the Cunard, White Star, Hamburg-American, North German Lloyd, Elder Dempster, and other steamers for cabin heating, &c. The system has been working for four years on the German ships without giving any trouble.

The simplest arrangement such as would be suitable for controlling one radiator on a 100-volt circuit is shown diagrammatically in fig. 1, and consists of a thermostat with a two-way selector switch (carrying about 12 volts and $\frac{1}{10}$ amp.) and a circuit breaker, the magnet or relay coil of which is energised by the closing of the thermostat contacts, and which in turn closes the radiator or main heating circuit.

Each thermostat case contains two thermostats, each set for a prearranged temperature, and either of which can be switched in or both switched out by the two-way selector switch.

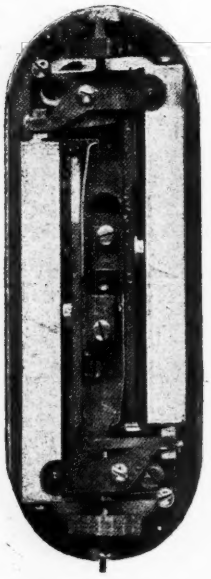


Fig. 2.—Interior of Geissinger Thermostat.

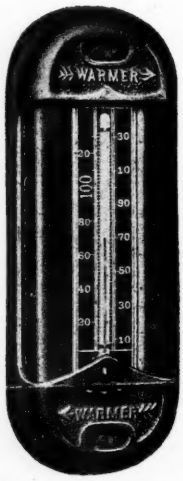


Fig. 3.—Exterior of Thermostat.

The thermostat proper is a patented device operating by means of the expansion of a channel-shaped bar, between the ends of which a bowed spring steel blade is held; the latter carries a platinum contact at its centre, which, as the supporting bar contracts, closes a circuit through a similar fixed contact. An electromagnet in the thermostat circuit allows a time lag in the operation of the contacts, which are fully adjustable as to position. The pressure between the contacts is mechanical and fixed, and not dependent upon any difference in temperature from the standard at which the dence is supposed to act.

The thermostat could not carry the main current for even the smallest heater, owing to the limited expansion and contraction of its parts and very small break at the contacts, and only a very small current of low voltage can pass if arcing is to be entirely eliminated. To meet this condition in the case of a 100-volt D.C circuit, a 40-ohm resistance is shunted round each thermostat and relay coil, the latter having about 120 ohms resistance, and eight separate thermostats, each with a 40-ohm shunt (for controlling eight heaters) would be permanently connected in series across the mains. In the

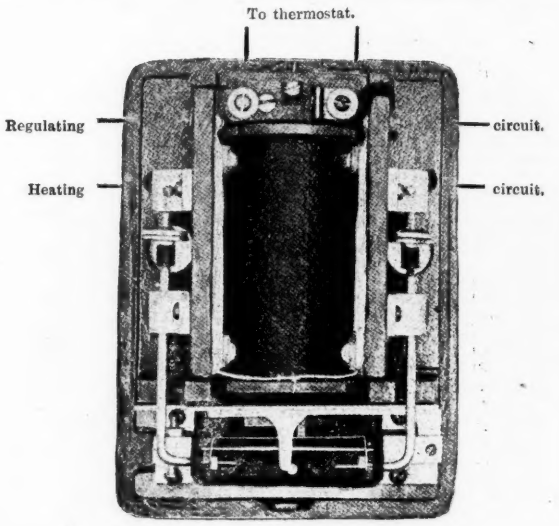


Fig. 4.—Automatic Circuit-Breaker.

case of the single radiator shown in fig. 1, an additional line resistance of 280 ohms is inserted to take the place of the seven displaced resistances, and for higher or lower line voltages the resistance would be varied accordingly.

Where a series of rooms, such as is referred to above, are equipped on this system, only the thermostats and heaters are placed in the rooms, the eight automatic switches being arranged

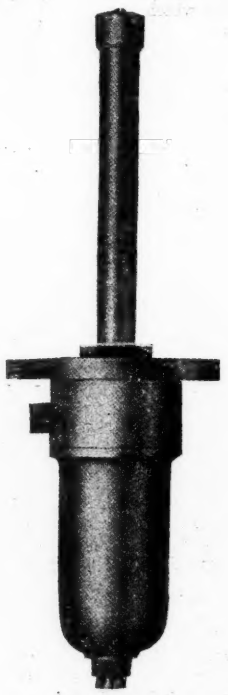


Fig 5.—Special Vibration-proof, Tank Type, Sealed Geissinger Thermostat.

in a cabinet which is installed in a corridor or passage, and also contains a master switch, by means of which the regulating circuit (carrying $\frac{1}{2}$ ampere) can be opened and all the heaters in connection cut off.

The pre-arranged temperatures for the duplicate thermostat are usually 65° and 70°, and are adjustable by means of a key.

Obviously the thermostat must be placed so as to give a true indication of the general temperature in the room, away from sources of heat, outside walls and draughts. It is claimed that the

positive nature of the contacts and freedom from the effects of vibration have eliminated all the sources of trouble which exist in the old type of compound bar thermostat.

The system has been applied to the control of electrical, steam and hot-water heating, and not only is greater comfort obtained through the elimination of overheating, but a considerable saving in energy results in the case of electrical heating.

In the case of the New York Central Railroad, on which this system of temperature control with electrical heating has been in use, 186 equipments being employed, it is estimated that ·84 unit per car-mile without, and ·59 unit with the Geissinger regulator, were consumed on the average for heating, and the saving was figured at £1,250 for the season.

A special form of tank type thermostat, vibration proof, is supplied for the temperature control of tanks, chambers, ovens, &c., in which case the part of the thermostat which is sensible to temperature changes consists of a hermetically sealed 1 in. metal tube projecting about 9 in. into the tank or chamber.

Thermostats of this type to control temperatures up to 1,000° F. are manufactured. The control is arranged to operate motors, valves, dampers, &c., connected with the sources or distribution of heat and cold, and so designed that in the event of failure of the current, the consequent error in temperature will be on the safe side.

It has been applied in the case of powder magazines, refrigerators, hot-water and liquor tanks, gas-heated ovens and chambers. sterilisers, &c.

Ventilated Bracket Insulators.

A type of insulator which has recently been considerably used in high-tension work consists in a "rotation body" of smooth porcelain resting on a suitable plinth. The porcelain is, for constructive reasons, made hollow, the internal space being more or less perfectly cut off from the outer air. Where this construction has been employed, temperature differences between the air outside and within the insulator body have led to considerable condensation of moisture on the inner wall. This condensation diminishes the insulation of the line and raises the capacity of the insulator (and therefore the equivalent capacity of the whole line), since the inner surface of the insulator may be regarded as earthed by this film of condensed moisture. Under such conditions the only effective dielectric is the porcelain itself.

The prevention of this condensation would obviously enhance the value of the insulator, and, with this end in view, tests have been conducted on insulators in which the hollow space has been hermetically sealed by a cemented metal plate. The formation of a water film cannot be completely prevented by this means, and a better solution to the problem is to ventilate freely the inside of

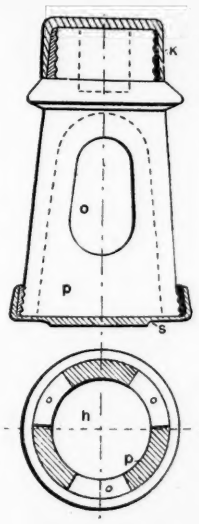


Fig. 6.—Ventilated Insulator.

the insulator by openings in its walls. The accompanying illustration (reproduced from a recent issue of the *E.T.Z.*), shows such an insulator with three openings *o* connecting the hollow space *h* with the outer air. The porcelain body *p* is cemented on to a tray *s*, and provided with a cap *k*. The side openings can be arranged in any number and form, provided the requirements of mechanical strength are observed, and efficient ventilation is secured.

The openings *o* permit free air circulation during the baking of the insulators, and thus secure quicker and more uniform drying while reducing the risk of cracks. The new construction offers important economies in material, price and weight of finished product.

A number of these insulators can be erected one above the other, progressively smaller sizes being used. The same perforated type of insulator illustrated, and the principle of ventilating internal spaces, are respectively applicable to various electrical apparatus and various types of insulators. In oil-immersed apparatus the side apertures ensure that the insulator shall become completely filled with oil, thus raising the total insulation of the whole.

New Polarised Telegraph Relay.

The Kamm polarised telegraph relay consists of a permanent magnet *n s*, a differential electromagnet E, E¹, and two armatures rigidly connected by a non-magnetic piece A. The permanent magnet induces similar poles at the ends of each armature, and the whole armature system is pivoted in a vertical axis. Connection is made to the lower end of the spindle through a mercury cup, and

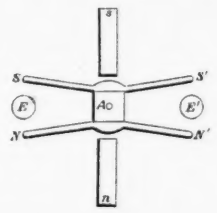


Fig. 7.—Kamm Polarised Telegraph Relay.

the upper end of the spindle carries a lever playing between two contact points. Currents flowing through the electromagnet windings induce opposite poles in E, E¹, the attractive and repulsive effects of which are clockwise or anti-clockwise as the case may be. The relay is specially applicable to high-speed telegraphy, and for use in conjunction with instruments requiring a very weak current. It enables 400 words to be received per minute with a working current of only 0·1 milliampere.

Automatic Electric Range and Fireless Cooker.

The Copeman Electric Stove Co., Flint, Mich., has recently placed on the market a line of electric ranges in which automatic operation in combination with the fireless cooker principle is a noteworthy characteristic. These stoves are made in three size s

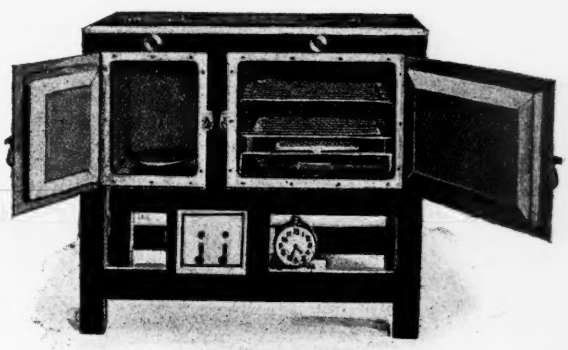


Fig. 8.—Automatic Electric Range and Fireless Cooker.

to serve from two to 20 persons, and on account of their automatic features are colloquially known as "silent servants." They are built with from one to three compartments, and are equipped with a special type of alarm-clock movement, which switches energy into circuit at a predetermined time, and an adjustable thermostat which cuts off the supply of energy after the temperature of the cooking compartments has risen to the point for which the thermostat has been set by the cook. The edibles then continue to cook by the retained heat of the ovens, the latter being enclosed by insulation which enables the food to be kept hot for hours without the consumption of additional energy.

In the two-compartment stove, which is representative of the line, separate baking and boiling sections are provided, which can be operated independently or jointly. Both ovens are controlled through the circuit-breaker by means of the clock, or they can be set and operated manually. The dimensions of the boiling compartment are 13·5 in. × 10·5 in. × 10·25 in., the baking compartment being 13·5 in. × 18·75 in. × 12 in. The standard equipment for this stove is one 8-in. heater for the boiler, one bar heater in the oven, one heat shield and distributor, two wire oven racks, two receptacles on top to receive the heaters when external cooking or heating is required, and two snap switches for operating the top heaters. These extra heating units make it unnecessary to remove the heaters from the compartments except for cleaning purposes. The connected load is 1,815 watts at 110 volts. The largest stove of this type has a connected load of 3,960 watts, and the smallest size requires a maximum of 1,485 watts, assuming all units in full operation. Either alternating-current or direct-current supplies may be utilised. On account of its economical characteristics, the Copeman stove is not designed for high-speed cooking, as in a gas range, but the makers contend that the saving of a small amount of time is of less importance than the economical consumption of energy and the improved quality of cooking when the process is not hurried. The Copeman clock, which has been specially built for stove operation, resembles an ordinary alarm clock with the exception of the increased strength of the spring drive. The stove

enables meals to be prepared and left to cook with a freedom impossible in a coal or gas range. The makers state that it will compete in economy with gas at $1 per 1,000 cb. ft. where electricity is utilised at 10 cents per KW.-hour or less.—*Electrical World.*

The Zipp H.T. Detector.

For some time the LAND UND SEEKABELWERKE A.G., of Cologne-Nippes, have been making a patented device for the purpose of detecting whether an A.C. conductor is alive or not.

The device is based on the principle of displacement currents, caused by the mounting in series of a condenser and current indicator with an A.C. conductor.

The condenser is tested to double the working pressure at which it is to be used, and a Geissler tube is used as the current indicator, mounted inside a strong glass tube, part of it being visible through a slot in the ebonite containing tube.

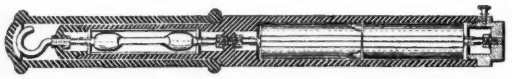


FIG. 9.—H.T. DETECTOR.

At one end is a hook, which is connected with the conductor to be tested, after an earth connection has been made to a terminal at the other end of the device. One condenser cell is supplied for each 5,000 volts, the condensers being mounted in series, and thus increasing the length of the ebonite tube according to the working pressure; a hollow handle is also provided, which can be unscrewed and attached as a cover over the opposite end of the detector carrying the hook, the device thus measuring 30 cm. long × 4 cm. diameter for up to 5,000 volts, with an additional 7 cm. in length for each condenser added.

DAMS FOR WATER.

[COMMUNICATED.]

ENGINEERS engaged on power work may frequently be called upon to design a small dam for a condensing pond, or a reservoir for general storage, or for softening work. Often it is desirable to use as a dam a brick wall set in cement mortar, or a brick tank may be built. The expense must be a minimum, but there must be no risk of accident. The stability of a brick wall has no relation to its length, unless this is so short as to enable a short dam to act as a beam. A short and unimportant dam wall may always be built as an arch convex to the pressure. But in the case of a long dam the arch principle cannot be carried out in its entirety, for an arch can only act by yielding to the stress upon it, and obvious difficulties arise where a yielding arch is joined to an unyielding bedrock, for there must be a gradual and not sudden transition from the dam as an arch to the dam as a fixture. Such cases are in the province of the civil engineer. For ordinary small work no brick wall should be less than 1½ bricks thick, and it should be built with a collar joint of cement—*i.e.*, a solid line of cement running continuously through the wall in length and height at each course. As a rule, a wall so thin as 14 in. at the base will not be built. The collar joint is intended to form a water-tight wall joining each horizontal bed of cement mortar.

A usual rule for the thickness of a retaining wall at its base is two-thirds of its height, in order to resist the overturning moment. The formula for overturning moment is $P = 10{\cdot}4\ H^3$ where H is the depth of water in feet and P is the pressure exerted at one-third the depth of water measured upwards—that is, 2 ft. from the base in 6 ft. of water; P is the value of the moment in foot-pounds, and must not exceed the moment of stability of the wall section. This moment is the product of 1-ft. length of wall by the distance from the outer toe of the wall to a perpendicular through the centre of gravity of the section. Thus in a pond 6 ft. deep, the overturning moment is P × 2 and $P = 2{,}246\ H$, or $10{\cdot}4\ H^3$. P is supposed to be the water-pressure concentrated along 1 ft. length of wall at a height of one-third the depth. Then P × 2 = 4,492 ft.-pounds. If the wall is, say, 2 ft. thick at the top, and 4 ft. thick at the base, and has equally battered sides, and 1 cb. ft. of brickwork weighs 150 lb., the moment of stability will be $\left(\frac{4+2\times 6}{2}\times 150\right)\times 2 = 5{,}400$ ft.-lb., or 900 lb. in excess of the overturning moment. With the same bulk of material, the margin of stability would be materially increased by making the wall 18 in. at the top and 4 ft. 6 in. at the base. The resultant of the water-pressure and the wall weight ought to intersect the base at a point that is at least within the middle third of the thickness at the base. No special danger will arise if the intersection fell a little to the water face of the middle third, but this is unlikely.

In the figure this is shown graphically, P being $10{\cdot}4\ H^3$ as before. Here *a b* = P to any convenient scale, and *a c* = W where W = the weight of a foot length of wall of the section *e f g h*. The centre of gravity is at O; *a c* is drawn vertically through O, and the diagonal *a d* of the completed rectangle *a b c d* cuts the base at *n*. Then *h n* must be greater than one-third *h g*. For all ordinary purposes the water face *e g* may be a straight line and vertical. But in high dams it is usual to shape the water face, as per dotted line, or, when the dam is empty, the pressure on the masonry at the base becomes excessive. This is of no moment for dams within the scope of this article.

Where a brick tank can be built more or less underground, a good plan to follow is to make an approximate calculation to ascertain how deeply the tank may be buried in order that the excavated spoil may be piled into a bank round the unburied part of the tank. This plan saves excavation, saves carting away of spoil, and saves brickwork. Even a rectangular tank will not fail inwards if the spoil is well rammed in the outer banks, and

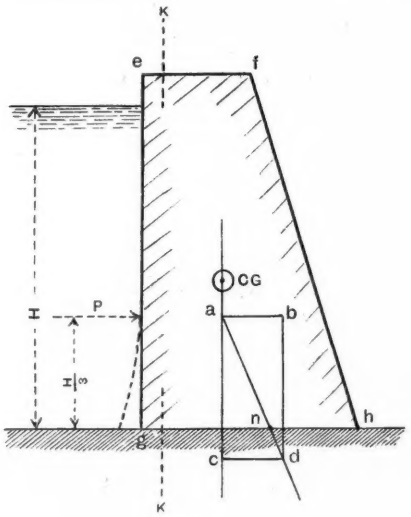


FIG. 1.

these are nicely smoothed and sodded. But if the dirt is not of the kind to be too stable in a bank, there may be internal counterforts built to stiffen the wall when the tank is empty.

The best form of half-buried tank is circular. The writer has built these 12 ft. deep and 30 ft. in diameter, finished externally with grassed slopes so as to be hardly perceptible at some little distance. They may be covered with a concrete roof supported on girders with a pillar or two, and soiled over and sodded to keep them dark and cool. Such a tank need not be thicker than 14 in., the interior being of rough brick cemented smooth. The earth in the outer bank is rammed in layers, which slope upwards from the brick wall and give a maximum of resistance against the internal pressure. In a circular tank there is no fear of collapse from the outside.

When there is plenty of concrete material at hand, the wall may be of this material, a band of hoop iron being buried in the heart of the wall at intervals. Or round ½-in. rods with their ends turned a couple of inches may be used, the rod ends lap-jointing a couple of feet upon each other, so as to secure continuity of tension effect. These circular

tanks are built to a gauge board carried by two arms from a central pillar in order that the excavation and the building may be accurately circular.

In a dam such as fig. 1, hydraulic pressure must not be able to exert itself between horizontal joints, or it may overturn the wall. If the material is such that there is any fear of such an occurrence, a wall may be bolted to its foundation by bolts along the line K K. These would be a safeguard against any joint becoming opened. Another safeguard is to cover the whole water face with a sheet of tar laid on in several coats effectually to water-proof all the joints.

The writer has more than once come across water tanks in process of construction which would inevitably have failed when full of water, the line of pressure falling far outside the base. In one case the tank wall, itself insufficient, was built on the top of a retaining wall 17 ft. high, and no provision of any sort was made to prevent the prompt overturn of the entire wall.

Such construction jobs do occasionally fall into the hands of men who have no engineering training whatever. Any failure of their work would reflect upon any engineer who might happen to be associated with other parts of the work, and it certainly can do no harm to keep a watchful eye on such matters, for, after all, anyone who sees a danger and does not tactfully point it out is an accessory in a sense to the result. But in two cases in which architects have been warned the warning was received in no good spirit. Still, that does not justify one in letting a man fall over a precipice.—B.

SOME IMPRESSIONS OF THE BOSTON ELECTRIC SHOW.

By ELIZA J. DUGDILL.

On September 28th last, the largest and finest electrical exhibition the world has ever known was opened in the large Mechanics' Buildings, Boston, Mass., U.S.A.

It was impossible for a stranger to go within a mile of the "show" and not become aware that an electrical exhibition was in progress. Huntingdon Avenue, where the Mechanics' Buildings are situated—the widest thoroughfare in Boston—was lit as far as sight could reach with arc lamps, white and blue, in clusters of three and five, at intervals of a few yards. On the Mechanics' Building itself every ledge and angle was outlined with incandescent lamps, after the manner of our White City decorations; only here the lamps were coloured, and in prominent places and over doorways a perfect network of various-coloured lamps was arranged in fanciful patterns.

As our own goods were delayed in that most irritating place, the Customs—we had to pay 45 per cent. duty, while American fittings makers can send their goods into England free—I took the opportunity of a quiet walk round the Exhibition. The decorations alone were worth a visit. There must have been many thousands of lamps on each floor—basement, first floor and second floor. The ceilings were covered with festoons of lamps and coloured muslin; in the centre of the first floor, where the second floor formed a gallery, the festoons radiated from the centre of the ceiling, forming a canopy which was very picturesque, viewed from either above or below.

Regarding the exhibits, except in detail, there was nothing new to me after our London Exhibition in October, 1911, unless it be an apparatus for milking cows, and I found that, to the American electrician, our own goods were the only new things.

The Boston Show was a real live one; as different from our London exhibition as a busy workshop differs from a shop window show. Electricity was shown applied to the manufacturing of shoes, furs, candies, mineral waters. Pop-corns were roasted wholesale, ice cream frozen, meat preserved in electrical cold storage, and potato chips were fried. I hope we shall always veto the last of these from our English exhibitions. There was a large laundry; cleaners and dyers; and a bakery that turned out 700 loaves a day, which were untouched by human hand until extracted from the ovens. There was the electrical printing exhibit, where the type was set and cast, the Linotype and Monotype machines, where a *Daily Show News* was printed.

There were all kinds of farm implements to which electric driving could be applied, and besides these, there was the exhibition of goods, as seen in our English exhibition, lamp-making, &c.

Electric fittings made in America are clumsy when compared with English. There were a few handsome Louis fittings and the leaded glass standard, and a way of lighting a room by inserting lamps in saucer-shaped glass, suspended from the ceiling in baskets, the light being thrown upwards, and producing a pretty effect.

Counterweights are not now allowed, and suspended cords are as thick as cables; they have a wood ball in the centre, with a hole through which the surplus cord is left in a loop. Lampholders are nearly as large again as our bayonet socket; the Edison screw seen here is not now allowed in America. The outer shell reaches to the bottom, and there is a lining of fibre. A gallery must be fixed on to hold the shade, or a piece of screwed tube forced on, the shade having a thread on the top opening to screw on, and not being held with a shade ring, as here.

There is a system in vogue of fitting American houses with fixtures that will do either for gas or electricity. I saw several of the dual fixtures in houses, and they were a positive eyesore, both in finish and design. An interesting exhibit was the long-distance telephone. Trumpets were hung on the walls, and notices, instructions, songs and music, were given through them to the whole room.

Crowds came every day. In one day we had as many as 45,000 visitors. The Edison Co., who promoted and financed the Exhibition, cleared all expense by the end of three weeks. I did not find that the exhibitors expected doing much business while the exhibition was in progress; the advertising spirit seems to be very strong in the American.

The relations between exhibitors and management were very cordial indeed. I do not remember hearing one complaint.

The terms used by electricians differ from ours. Lampholders are "sockets," fittings are "fixtures," aluminium is "alloominum." They talk of people coming "rubbering round" (Anglice, quizzing), and anyone over-curious is designated a "rubber-neck."

Visitors, instead of asking "What is the price?" say "What expense is it?" or "How expensive is it?"

Lectures in domestic applications were a popular feature of the Exhibition. The Exhibition was a well-earned triumph for, and a credit to, the promoters. I shall remember with pleasure my sojourn amongst the bluff, but kindly Americans.

Electric Heating of the Stands at Olympia.—An opportunity for the authorities responsible for the world's largest trade exhibition to show their enterprise presented itself in the problem of heating the show stands at Olympia, during the run of the Motor Exhibition. We are pleased to record that electric heating was decided upon, the contract being awarded to the General Electric Co., Ltd. This is probably the largest electric heating job undertaken by any firm, and was carried out as follows:—The company decided upon the principle of radiation as being the best system of transmitting heat quickly and efficiently, especially as unwelcome draughts are not always avoidable in a huge building like Olympia. Accordingly radiators, fitted with cheerfully glowing lamps, were employed. All the radiators were of the same pattern, specially made up by the General Electric Co., Ltd., for the Exhibition. Each radiator was fitted with four "Robertson" radiator lamps. The radiator bodies were of very neat design, and were constructed of sheet steel with a black matt finish. They were also equipped with copper reflectors, placed behind the lamps, to assist in the radiation. Switches allowed of proper control of heat. In no other way could local heating—which is a special feature of the electrical method — have been so effectively and easily employed.

Tools for Electricians in the Navy.—Lord Charles Beresford, in the Parliamentary Papers, asked the First Lord of the Admiralty whether the Admiralty would supply the following tools for the use of electricians of his Majesty's ships, viz., set of $\frac{1}{8}$ type, set of chasers, 8 to 24 threads, Whitworth thread gauge, set of small carriers, set of small tools for instrument repairs, small surface plate and scribing block, small American brace in lieu of Archimedean drill, and milling attachment of lathe; and whether he was aware that electricians had to borrow these tools from other parts of the ship, which caused confusion. Dr. Macnamara, in reply, said that the general question of tools was under consideration, and considerable additions had already been made. It would not be economical to provide all departments with the same tools, and a certain amount of borrowing must take place, but with proper organisation confusion should not arise from this cause.

Steel Transmission Structures.—The quantities of steel entering into the construction of some of the great transmission systems may prove surprising to those who underestimate the importance of tower structures. The Southern California Power Co. has used to date 20,000 tons of steel tower construction. For the 150-mile transmission from the Mississippi River development at Keokuk, Iowa, to St. Louis, 10,000 tons have been ordered. The Georgia Railway and Power Co.'s system comprises 5,000 tons, and the Connecticut Power Co.'s lines 3,000 tons. In comparison with these figures it is interesting to note that an average ten-story office building, occupying ground 80 ft. × 150 ft., requires about 1,200 tons of steel, and that the large Californian system above cited contains enough to build a dozen steel-arch bridges like that spanning the gorge at Niagara.—*Electrical World.*

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

25,195. "Magnetic separators or combined separators and screens." J. T. Pollard and R. Emmott. November 4th.

25,207. "Alternating-current generators." Ateliers de Constructions Electriques du Nord et de l'Est. (Convention date, November 8th, 1911, France.) November 4th. (Complete.)

25,225. "Telephone conversation cabins." F. J. J. Gibbons. November 4th.

25,258. "Locking devices for the gates or doors of electrically-controlled lifts and the like." F. Barlow. November 4th.

25,278. "Electrically-operated time-indicating devices and the like." L. J. Aron, C. E. Harrison and X. L. Electric Co., Ltd. (Addition to 20,268 of 1911.) November 4th.

25,286. "Automatic regulating devices for electric distribution systems." British Thomson-Houston Co., Ltd., and C. M. Jones. November 4th.

25,300. "Secondary batteries." A. M. Taylor. November 5th.

25,318. "Electric arc lamps." G. Nicholson. November 5th.

25,321. "Magnetic lock for railway carriages and the like." D. G. Thomas. November 5th.

25,356. "Alternators." E. Girardeau. (Convention date, November 6th, 1911, Germany.) November 5th. (Complete.)

25,359. "Electro-deposition of alloys." S. O. Cowper-Coles. November 5th.

25,366. "Dynamos." C. L. Breeden and H. E. Moore. November 5th. (Complete.)

25,370. "Refractory materials." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) November 5th.

25,372. "Thermo-electric batteries." H. O. Gross. (Convention date, November 6th, 1911, in Germany.) November 5th. (Complete.)

25,374. "Magneto trip-gear for internal-combustion engines." Bristol Wagon and Carriage Works Co., Ltd., and W. A. B. Copsey. November 5th.

25,382. "Printing telegraph systems." Western Electric Co., Ltd. (Western Electric Co., United States.) November 5th. (Complete.)

25,384. "Telephonic transmitters." E. A. Graham. November 5th.

25,386. "Engine starting and lighting systems for motor vehicles." J. B. Entz. (Convention date, March 11th, 1912, United States.) November 5th. (Complete.)

25,411. "Electrical relays and indicating, recording, and re-transmitting apparatus." J. S. Enright. November 6th.

25,420. "Switches for use in connection with the electric lighting systems of automobiles." B. Brooks and W. Holt. November 6th.

25,424. "Incandescent electric lamps." F. E. Wooldridge and E. B. Barlow. November 6th.

25,449. "Sourdine or damper for telephones and telegraphs." R. Schaefer. November 6th. (Complete.)

25,518. "Self-acting switch devices." Schott & Gen. (Convention date, November 13th, 1911, Germany.) November 7th. (Complete.)

25,519. "Miners' electric safety lamp." J. Field. November 7th.

25,531. "Driving magneto ignition devices." D. H. O'Flaherty. November 7th.

25,535. "Electric, gas, or oil sign reflector lamps." T. H. Williamson. November 7th.

25,536. "Reflectors for electric incandescent lamps." F. W. Suter. November 7th.

25,539. "Electric light wire casing particularly applicable to ships' panelling, partitions, and ceilings." W. G. Wakeham. November 7th.

25,540. "Electric signal." J. Fielder. November 7th.

25,551. "Alkaline electric accumulators." W. N. Stewart and E. Foss. November 7th.

25,554. "Boxes for electric batteries or accumulators." H. Lucas and O. Lucas. November 7th.

25,563. "Electric clock systems." A. R. Upward. November 7th.

25,580. "Sparking plugs." M. Naret. November 7th. (Complete.)

25,586. "Electric cooking apparatus." R. S. Downe and Brompton and Kensington Accessories Co., Ltd. November 7th. (Complete.)

25,591. "Controllers for electric motors." L. G. Riley. (Convention date, November 8th, 1911, United States.) November 7th. (Complete.)

25,603. "Dynamo-electric machines." B. Brooks and W. Holt. November 8th.

25,608. "Electric safety lamps and the like." A. Abell, W. E. Ross and A. E. Silkstone. November 8th.

25,633. "Electric pocket lamps and their application to signalling purposes." H. Neuburger. November 8th.

25,646. "Magneto-current generators." E. Podlesak. (Divided Application on 10,209/12, April 30th.) November 8th. (Complete.)

25,670. "Paper strip gathering devices, particularly applicable to telegraphic tape work." H. W. Higham and Remington Typewriter Co., Ltd. November 8th.

25,673. "Telephone instrument set adapted for two lines." Siemens Bros. and Co., Ltd., and E. A. Laidlaw. November 8th. (Complete.)

25,704. "Brush raising mechanism for dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. November 8th.

25,733. "Motor-car and other electric lamps which are furnished with parabolic reflectors." F. A. Griffin. November 9th.

25,734. Means for connecting wires to incandescent electric lampholders." F. A. Griffin. November 9th.

25,742. "Electrical conductors." M. J. Railing and L. C. Holt. November 9th.

25,748. "Method of and means for recording telephone calls." A. E. Lamkin and F. Mead. November 9th.

25,775. "Connectors for electric conductors." British Thomson-Houston Co., Ltd. (General Electric Co., United States). (Complete.) November 9th.

25,784. "Depolarising agents for galvanic cells." British Ever-Ready Electrical Co., Ltd. (Albrecht Heil, Germany). (Complete.) November 9th.

25,787. "Electric time switches." W. Hutmann and C. Haberl. November 9th. (Complete.)

Electric Vehicles for South Africa.—The question is raised by the *South African Mining Journal* whether there is not a good opening in South Africa for the electrically-propelled wagon; the increasing cost of motor spirit, and the excessive noise prevailing in Johannesburg, are strong arguments in favour of the efficient, reliable and silent electric vehicle, which is also able to show lower running costs than the petrol-driven wagon.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electric Switches. G. H. White. 9,686. April 21st. (October 21st, 1911.)

Compensation of Polyphase Commutating Dynamo-Electric Machines. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 16,737. July 20th.

Heat-Storage Devices. British Thomson-Houston Co. (General Electric Co.) 18,676. August 18th.

Operation of Electrical Machines of the Induction Type. W. A. Price. 20,709. September 19th.

Dynamo-Electric Machines. E. R. Clarke. 22,987. October 18th.

Semi-Automatic Telephone Exchange Systems. F. R. McBerty. 23,508. October 24th. (October 24th, 1910.)

Means of Simultaneously Recording or Reproducing Sounds and Visible Movements Accompanying such Sounds. A. Rosenburg. 23,620. October 25th.

Automatic Electrical Signalling Systems for Railways and the like. W. C. Hawkes and E. J. Cleburne. 23,846. October 27th.

Electric Water Heaters. A. P. Nichols. 24,445. November 3rd.

Electrically-driven Planing Machines and Similar Reciprocating Tools. Vickers, Ltd., and A. D. Williamson. 25,459. November 15th. (Cognate application No. 5,544 of 1912.)

Process for Carrying Out Gas Reactions in an Electric Furnace. A. Helfenstein. 26,871. November 25th. (November 22nd, 1910.)

Apparatus for Heating, Evaporating, Volatilising or Distilling Liquids by Electricity. T. McClelland. 27,422. December 7th.

Electrical Accumulators. K. R. Smith. 27,542. December 8th.

Intercommunicating Telephone Systems. W. Fairweather. (Turner.) 28,165. December 14th.

1912.

Electrical Switches and Fuses Combined. R. W. Bill. 30. January 1st.

Electric Current or Energy Measuring Instruments. British Thomson-Houston Co. (General Electric Co.) 1,079. January 13th.

Manufacture of Electrodes for Galvanic Batteries. A. Wedekind. 1,198. January 15th.

Starting Switches for Rotor Circuits of Alternating-Current Motors having Wound Rotors and Slip Rings. J. G. Shaw and Shaw. 1,449. January 18th.

Electric Lighting Systems for Automobiles. J. Bijur. 1,753. January 22nd. (February 2nd, 1911.)

Electrical Heating and Radiating Apparatus. H. S. Martin. 2,764. February 2nd.

Registering Devices for Telephone Systems. E. M. Northum. 3,552. February 12th.

Electromagnetic Device for Warning against Theft and Burglary. H. L. C. Neuilly. 4,283. February 20th. (September 11th, 1911.)

Telephonic Transmitters. A. L. Struxiano. 6,393. March 14th. (March 14th, 1911.)

Galvanic Batteries. W. C. Banks and R. C. Wood. 6,758. March 19th.

Electrical Cut-in and Cut-out Devices for Use in Charging Accumulators. H. Leitner. 7,572. March 28th.

Electric Incandescent Lamps. P. C. Hewitt. 8,086. April 3rd. (April 8th, 1911.)

Electric Signal Switch. A. Beck and C. Beck. 8,714. April 12th.

Working of Metal. British Thomson-Houston Co. (General Electric Co.) 9,877. April 25th.

High-Speed Rotors for High-Frequency Multipolar Electrical Machinery. R. Goldschmidt. 10,507. May 3rd. (May 4th, 1911.)

Current Interruptor for High-Tension Lines. C. Clar and T. Clar. 12,320. May 2nth.

Electrically-Controlled Signals for Use in Determining Temperature. A. McNab. 14,653. June 22nd.

Wave Detectors for Radio-Telegraphy and Telephony. L. J. L. D. Thibault. 16,163. July 10th. (May 24th, 1912.)

Receiving Apparatus for Electric Waves. F. Schneider. 18,188. August 7th. (Addition to 18,086 of 1912.)

Electric Mercury Motor Meters. H. Gottschalk and H. Aron Elektricitäts-zahlerfabrik Ges. 18,810. August 16th.

Street Accidents.—In the Parliamentary Papers last week, Mr. Watt asked the President of the Board of Trade whether, having regard to the accidents through the speed of tramcars and of motor-cars in busy thoroughfares in the large cities in the country, he would consider the advisability of appointing a committee to inquire into and seek to prevent or minimise these accidents, in view of the fact that such a committee had been instituted to deal with motor-omnibus accidents in London. Mr. Robertson, in reply, said that the maximum speeds to be observed on tramway systems were fixed by the Board of Trade after the routes had been inspected, and were governed by the varying conditions which obtain on different routes. They were, moreover, subject to revision if fresh conditions arose. Compulsory stopping places were also provided where necessary. So far, therefore, as tramway traffic was concerned, the present system appeared to provide sufficient means of control; and, having regard to the fact that each locality required separate consideration, he doubted if the appointment of a committee, such as suggested, would serve any really useful purpose. The question, so far as it affected motor-cars, was not for the Board of Trade.